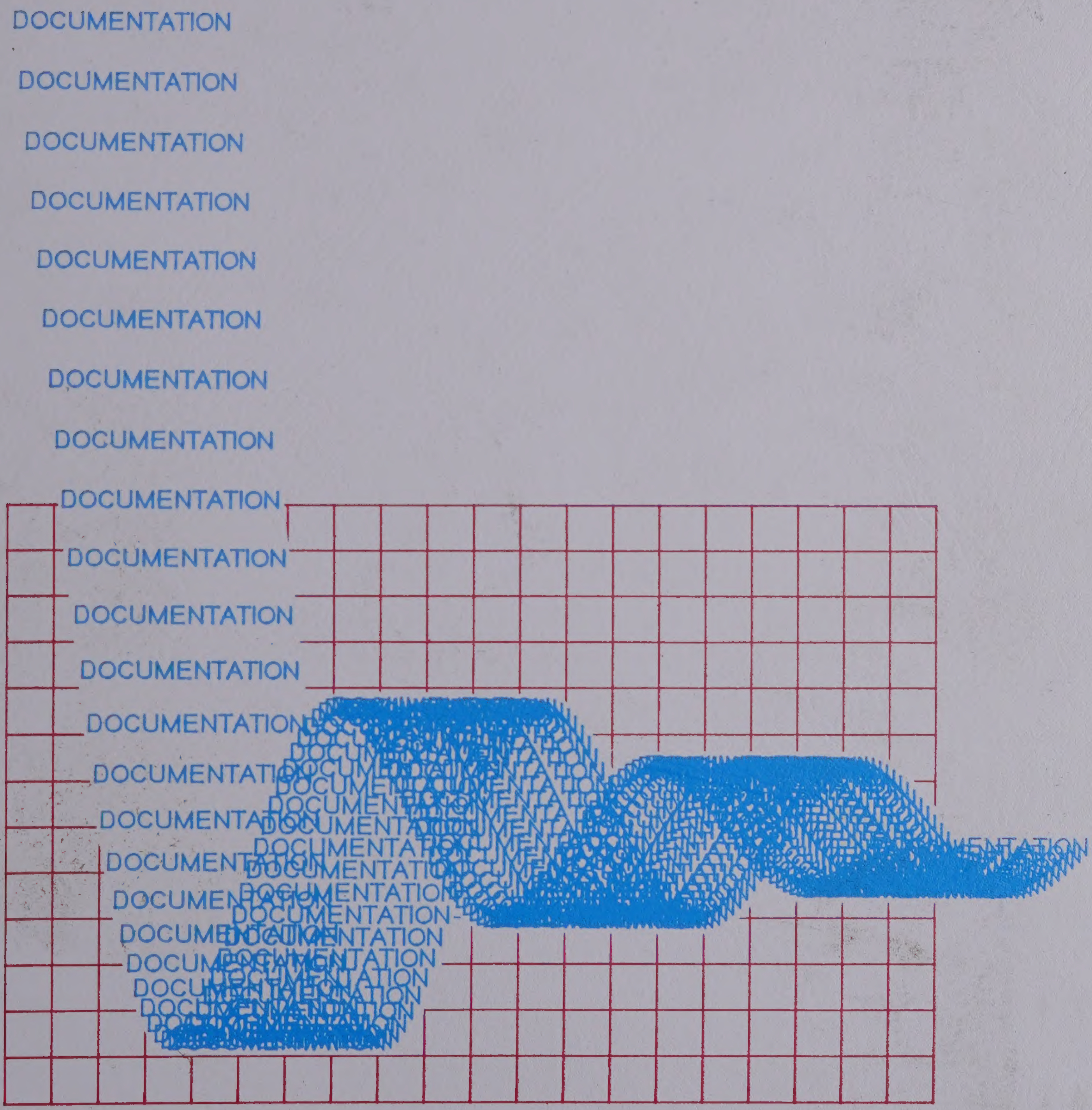
ROHDE&SCHWARZ



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3 Manual Control

This chapter gives a brief survey of the operating concept and the structure of the user interface for GSM mobile phone tests. The CMU was designed for maximum operating convenience and flexibility. All instrument functions are grouped together in menus, each of them provides a number of related configuration settings or displays a group of measured quantities. All menus show a similar structure so that many settings, once defined, can be used in several measurements. Switchover between the different menu groups and test modes *(Signalling – Non Signalling)* is possible at any time.

In the following, the different measurement modes and measured quantities are discussed. Settings and measurement parameters frequently encountered are explained from a general point of view.

The formal aspects of measurement control are discussed in more detail in chapter 5 *(Remote Control – Basics)*. For a presentation of the CMU's control elements, menu types and dialog elements within the menus refer to chapter 3 of the operating manual for the CMU basic unit.

Menu Structure

The menus used to control GSM measurements can be arranged in different ways. From the functional point of view, they form the following groups:

- The function groups *GSM400-MS, GSM850-MS, GSM900-MS, GSM1800-MS* and *GSM1900-MS*
- The two test modes *Signalling* and *Non Signalling*
- General configurations *(Connection Control)*, configurations specific to a measured quantity *(Power Configuration, Modulation Configuration, Spectrum Configuration, Receiver Quality Configuration)*, and menus displaying the results of the measurement *(Analyzer/Generator, Overview, Power (P/Time, P/Slot, P/Frame etc.)*, Modulation *(Extended Phase Error, Overview, EVM, Phase Error, Magnitude Error)*, *Spectrum (due to Modulation* and *due to Switching), Receiver Quality)*

In a more formal sense, the CMU uses main menus, popup menus, graphical measurement menus and dialog windows of various size. This aspect is discussed in chapter 3 of the operating manual for the CMU basic unit.

Test Modes

GSM measurements are performed in one of the two modes *Signalling* or *Non Signalling*. The *Non Signalling* mode is typically used for module tests or test of mobiles in a special "test mode". The *Signalling* mode serves to measure the mobile phone performance under realistic operating conditions where the CMU mimics a GSM base transceiver station.

Definition

The term signalling denotes all actions necessary to establish, control and terminate a communication between the base station and the mobile phone. The signalling messages conveyed allow the mobile station and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.

Non Signalling Mode

In the *Non Signalling* mode, the CMU generates an RF signal conforming to GSM specifications and analyzes the signal with GSM characteristics (i.e. with definite level in the designated channel and in the adjacent channels, definite phase and frequency, and bit content) retransmitted by the device under test. No signalling parameters are transferred so that test times can be reduced considerably. The test signal may be inside or outside the designated GSM channel range.

Normal burst signals are generated and analyzed. Various transmitter quality measurements (burst power versus time in one or several timeslots, average burst power in subsequent timeslots or frames, phase and frequency errors, error vector magnitude, I/Q imbalance and origin offset in the constellation diagram, adjacent channel power due to switching and due to modulation) can be performed. GMSK and 8PSK-modulated signals are supported. The measurement may be triggered by an additional external signal.

Signalling Mode

In the *Signalling* mode, the CMU starts to transmit a signal using a control channel. In subsequent steps, the mobile synchronizes to the control channel, decodes the information transmitted, and performs a location update so that a call can be delivered from either the mobile or the CMU.

The CMU is able to configure a broad range of network parameters and to determine the parameters characterizing the mobile. Measurements of the burst power versus time in one or several timeslots, of the average burst power in subsequent timeslots or frames, the modulation parameters (phase and frequency errors, I/Q imbalance and origin offset in the constellation diagram), the adjacent channel power due to switching and due to modulation, and of the bit error rate can be performed for normal bursts and access bursts. GMSK and 8PSK-modulated signals are supported.

If option CMU-K42 is installed in addition, the CMU can also establish a TBF connection to a mobile station operating in packet-data (GPRS) mode. Single-slot and multislot measurements can be done in the GPRS test mode.

Symbols for Signalling Mode and State

The *signalling mode* and *state* is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU200 operating manual). The following symbols occur in function group *GSM400/850/900/1800/1900-MS:*

📱 Non signalling mode; module tests

📱 Signalling mode, Signal Off

📱 Signalling mode, Signal On or GPRS Idle (symbol blinks)

📱 Signalling mode, Synchronized or GPRS Attached

📱 Signalling mode, Alerting or GPRS Connecting TBF (symbol blinks)

📱 Signalling mode, Call Established or GPRS TBC Established

Configurations

The CMU offers a wide range of settings for the RF signal generator and analyzer, the signalling procedures, and the individual measurements. Configurations can be set either for the whole function group *(Connection Control)* or for a particular measurement.

Connection Control

The *Connect. Control* softkey is located on the right side of the title bar of each main and graphical measurement menu. It opens a popup menu with several tabs controlling

- The signal generators and analyzers of the instrument *(Analyzer* and *Generator* in Non Signalling, *MS Signal* and *BS Signal* in Signalling mode)
- The CMU receiver settings and input path configuration (included in *Analyzer, MS Signal)*
- The trigger settings (included in *Analyzer, MS Signal)*
- The RF connectors to be used and the external attenuation *(RF Input/Output)*
- The reference signal and the system clock *(Sync.)*
- In *Signalling* mode, all actions changing the CMU's signalling state *(Connection)*
- In *Signalling* mode, a handover *(Handover)* to another network
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*

All settings made in the *Connect. Control* menu apply to the whole function group. Many of them can be overwritten, however, by means of the softkeys and hotkeys offered in the graphical measurement menus.

Configurations of measurements

A popup menu offering specific settings is assigned to each measurement group *(Power, Modulation, Spectrum, and Receiver Quality).* The following parameters can be defined:

- The repetition mode, the stop condition, the statistic count and the display mode for the measurement *(Control)*
- Tolerances for the measured quantities *(Limits, Limit Lines)*

These settings are explained in more detail below (see section *General Settings* on page 3.5).

Configuration via hotkeys

The softkeys and associated hotkeys in the graphical measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU200 operating manual. Settings may via hotkeys supersede the corresponding *Connection Control* settings.

Measurement Groups

Measurement results are indicated in two different ways:

- Discrete values and parameters are displayed in output fields, lists and tables. In remote control, these results are referred to as scalars.
- Measurement curves (traces) are displayed in a Cartesian coordinate system, the time forming the x-axis scale. Relatively small sets of test points are generally viewed in a bar graph. In remote control, results of this type are referred to as arrays.

While the measurement is running in repetition mode *continuous* (see page 3.5), the indicated results are constantly updated. As shown in the table below, the measurement groups are different for the two test modes.

Table 3-1 Measurement Groups in the *Signalling* and *Non Signalling* Mode

Non Signalling **(GMSK and 8PSK-modulated signals supported)**	**Signalling** **(GMSK-modulated signals supported)**
Analyzer/Generator Shows the settings for the signals generated and analyzed by the instrument and presents an overview of the basic scalar power and modulation results.	**Overview** Shows the settings for attempting a connection to the mobile and presents an overview of the basic scalar power and modulation results. The receiver parameters and various signalling parameters reported by the mobile station are indicated in addition.
Power Application *P/t Norm. GMSK/8PSK:* Diagram showing the power of a GMSK or 8PSK-modulated burst signal as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/t Multislot:* Diagram showing the trace of the measured burst power as a function of time in up to 4 consecutive timeslots. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/Frame:* Table showing the average burst power in a particular timeslot and in 128 consecutive TDMA frames. Application *P/Slot Graph:* Bar graph showing the average burst power in 8 consecutive timeslots. Application *P/Slot Table:* Table showing the average burst power in up to 512 consecutive timeslots.	**Power** Application *P/t Norm. GMSK/8PSK:* Diagram showing the power of a GMSK or 8PSK-modulated burst signal as a function of time. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/t Multislot:* Diagram showing the trace of the measured burst power as a function of time in up to 4 consecutive timeslots. The peak power, statistical results and the results of the limit check are indicated in addition. Single points of the trace may be evaluated using graphical tools (markers, D-Line). Application *P/t Access GMSK:* Diagram showing the power of a single GMSK-modulated access burst as a function of time including limit check. Application *P/Frame:* Table showing the average burst power in a particular timeslot and in 128 consecutive TDMA frames. Application *P/Slot Graph:* Bar graph showing the average burst power in 8 consecutive timeslots. Application *P/Slot Table:* Table showing the average burst power in up to 512 consecutive timeslots. Application *P/PCL:* Table showing the average burst power as a function of the PCL of the mobile phone.
Modulation Application *Ext. Phase Err. GMSK:* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, I/Q imbalance and origin offset in the constellation diagram, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK:* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK:* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK:* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modu-	**Modulation** Application *Ext. Phase Err. GMSK:* Diagram showing the phase error within the burst as a function of time. The frequency error, average and RMS phase error, I/Q imbalance and origin offset in the constellation diagram, statistical results and the results of the limit check are indicated in addition. Application *Overview 8PSK:* Table showing a statistical evaluation of 8PSK modulation parameters. Application *EVM 8PSK:* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters. Application *Magn. Error 8PSK:* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of 8PSK modula-

Non Signalling **(GMSK and 8PSK-modulated signals supported)**	**Signalling** **(GMSK-modulated signals supported)**
lation parameters. Application *Phase Error 8PSK:* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.	tion parameters. Application *Phase Error 8PSK:* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of 8PSK modulation parameters.
Spectrum Diagram showing the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.	**Spectrum** Diagram showing the amount of energy that spills outside the designated channel. The off-channel spectrum is caused by the modulation (spectrum due to modulation) and to the bursty nature of the RF signal (spectrum due to switching). Statistical results and the results of the limit check are indicated in addition.
–	**Receiver Quality** Table showing the results of the bit error rate test including the limit check and the receiver parameters reported by the mobile station. Bit error rates for different bit classes, the residual bit error rate and frame erasure rate, the raw bit error rate, and the data block error rate can be assessed in various measurement modes.

A graphical overview of the menus is given at the end of this chapter.

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups *Power*, *Modulation, Spectrum,* and *Receiver Quality*. In combination, these settings define the scope of the measurement, i.e. the number of bursts measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application

Applications are different measurements belonging to the same measurement group. They effectively split up a measurement group into various related subgroups which can be configured separately.

They are selected via the *Application* softkey in the measurement menus.

Statistic Count / Statistics Cycle

The statistic count is equal to the integer number of evaluation periods which form one statistics cycle. An evaluation period corresponds to the duration of a burst (measurement groups *Power*, *Modulation, and Spectrum)* or a speech frame (measurement group *Receiver Quality).* Depending on the *repetition mode* (see below), a measurement may extend over one or several statistics cycles.

The *statistic count* is set in the *Control* tab of the configuration popup-menus assigned to each measurement group.

Repetition Mode

The *repetition mode* defines how many statistics cycles are measured if the measurement is not stopped by a limit failure (see stop condition *On Limit Failure* below). Two modes are available for all measurements:

Single Shot	The measurement is stopped after one statistics cycle
Continuous	The measurement is continued until explicitly terminated by the user; the results are periodically updated

A third repetition mode is available in remote control:

Counting	Repeated single shot measurement with a fixed number of statistics cycles

The *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the three measurement groups *Power*, *Modulation,* and *Spectrum.* In the *Receiver Quality* menu, the repetition mode can be set via the *Application* softkey.

Note: *In contrast to other measurement settings, thee repetition modes in manual and remote control are independent and do not overwrite each other. In most measurements, the default repetition mode in manual control is* Continuous *(observe results over an extended period of time), the default mode in remote control is* Single Shot *(perform one measurement and retrieve results).*

Stop Condition

For *Power, Modulation, and Spectrum* measurements, two stop conditions can be selected:

None	The measurement is performed according to its repetition mode, regardless of the measurement results,
On Limit Failure	The measurement is stopped as soon as one of the limits is exceeded, regardless of the repetition mode set. If no limit failure occurs, it is performed according to its repetition mode.

For *Receiver Quality* measurements, the stop condition *None* (see above) and two further conditions can be selected:

1st Limit exceed.	The measurement is stopped as soon as one of the limits is exceeded
All Limits exceed.	The measurement is stopped as soon as all limits defined are exceeded. Again, if no limit failure occurs, it is performed according to its repetition mode.

The *stop condition* is set in the *Control* tab of the configuration popup-menus assigned to each measurement group.

Display Mode

In graphical measurement diagrams, the *display mode* defines which of the measured and calculated traces is displayed if the measurement extends over several bursts. In general, traces are evaluated at a set of fixed, equidistant test points (samples). After n bursts, n measurement results per test point have been taken. After a single shot measurement extending over c bursts, c measurement results per test point have been taken.

Current	The current burst, i.e. the last result for all test points, is displayed.
Minimum	At each test point, the minimum value of all bursts measured is displayed.
Maximum	At each test point, the maximum value of all bursts measured is displayed.
Max./Min.	At each test point, the extreme value of all bursts measured is displayed, i.e. the maximum or minimum, whichever has a larger absolute value.
Average	At each test point, a suitably defined average over all bursts measured is displayed; see paragraph on *Calculation of average quantities* below.

Note the difference in the calculation of *Average* on one hand, *Minimum, Maximum* and *Max./Min.* on the other hand, if the measurement extends over more than one statistic count (repetition mode *Continuous,* measurement time longer than one statistic count).

After evaluation of the different traces, the burst power is logarithmized and plotted in a semi-logarithmic diagram.

The *display mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Power, Modulation,* and *Spectrum.*

Calculation of average quantities

The *Average* traces in the *Power, Modulation,* and *Spectrum* menus are obtained as follows:

Let c be the number of bursts forming one statistics cycle (one *statistic count)* and assume that n bursts have been measured since the start of the measurement. In calculating the *Average* trace, the following two situations are distinguished:

n ≤ c Single shot measurement or continuous measurement during the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to the following recurrence:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \qquad (n = 1, \ldots, c)$$

The *Average* trace represents the arithmetic mean value over all n bursts measured.

n > c Continuous measurement after the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to:

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c)$$

Scalar quantities are averaged in analogy to *Average* traces. The formulas hold for n = 1 where the average trace becomes equal to the current trace (statistics off).

Calculation of statistical quantities

In *Power* and *Modulation* measurements the statistical functions *Average, Minimum, Maximum* and *Minimum/Maximum* are applied to a set of test points depending on two independent parameters:

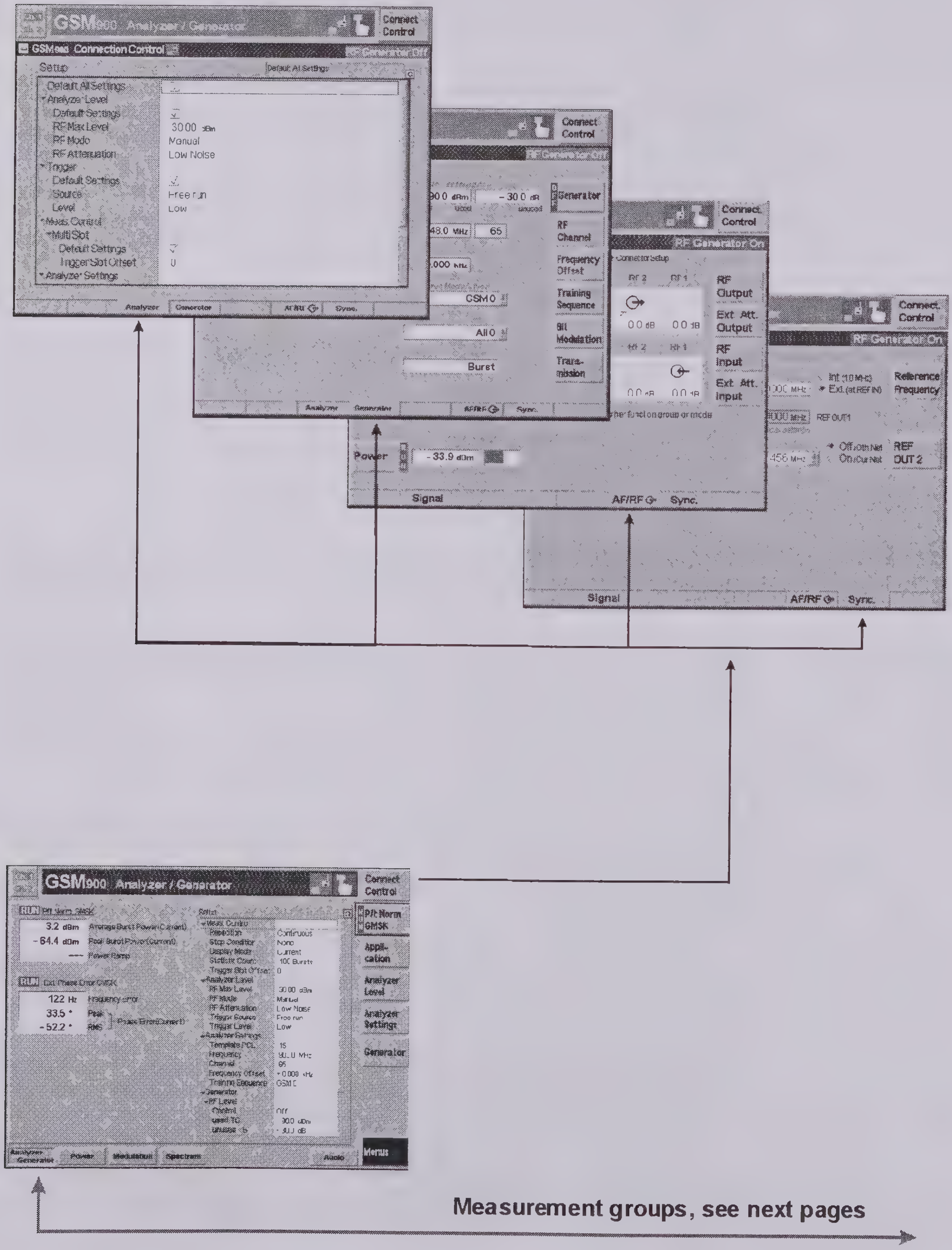
- The time, i.e. the abscissa values t_i, i ranging from 1 to the total number of test points comprising the trace.
- The burst number ranging from 1 to the number n of the current burst.

The result of the statistical operations depends on the parameter range considered and – in the case of statistics functions evaluated over several parameters – on the order of evaluations. This is why the definition of statistical quantities deserves some attention and is explained in the relevant sections in chapter 4. Some particular examples are:

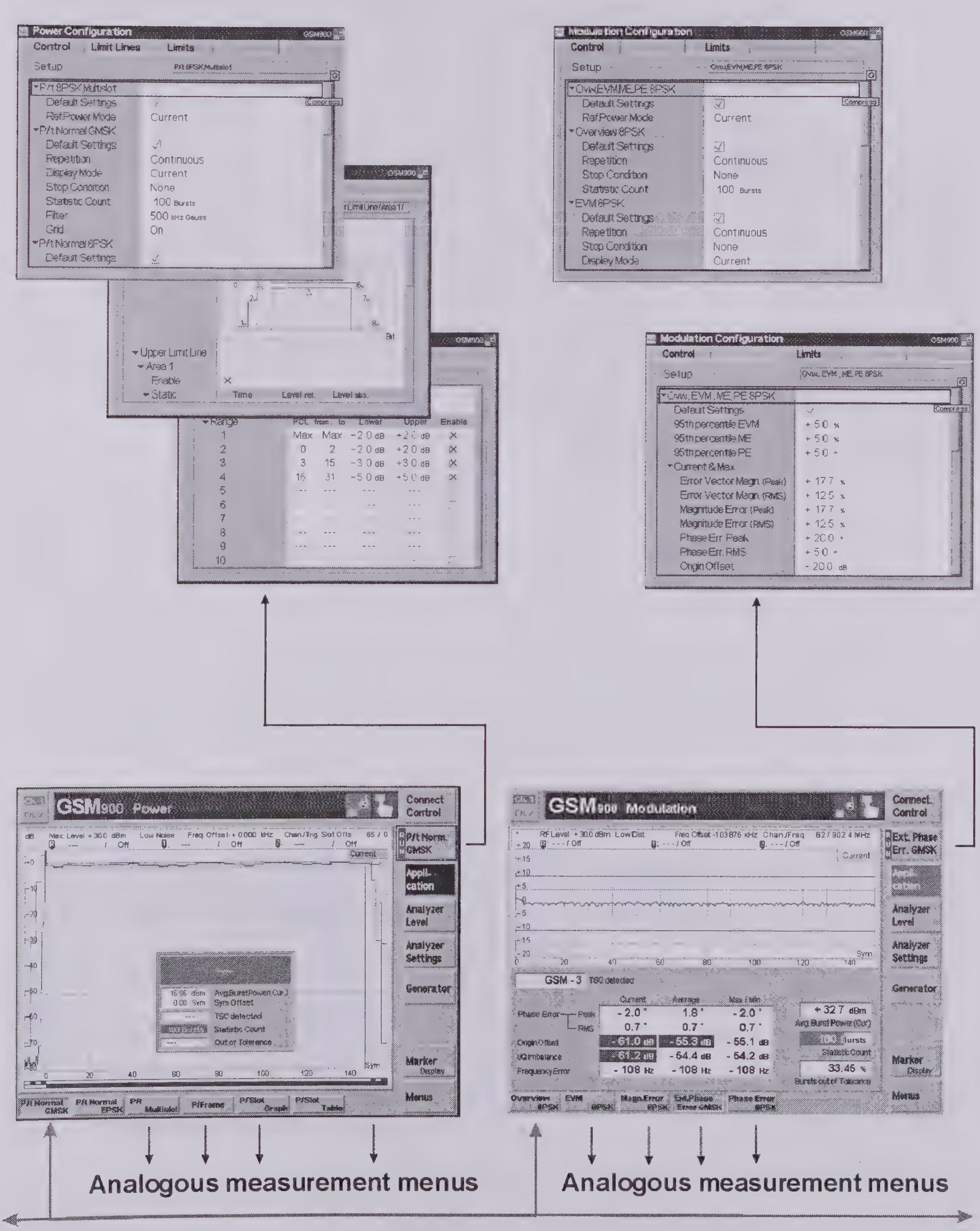
1. In the *Power* menu, the quantity *Average Burst Power* denotes the average power of the current burst. i.e. the arithmetical mean value of all test points t_i located in the useful part of the burst (lower area 1 in the power template in chapter 4).
2. In the *Modulation* menu quantities such as the *Frequency Error*, *Phase Error RMS, Phase Error Peak* etc. are first calculated for the current burst and entered in the *Current* column of the output table. The results in the *Minimum/Maximum* column correspond to the extreme value of the *Current* results calculated over all bursts measured. The results in the *Average* column correspond to the average of the *Current* results calculated according to the prescription in paragraph *Calculation of average quantities* above.

Menu Overview

GSM-MS Non Signalling – General Configurations



GSM-MS Non Signalling – Power and Modulation



Power Configuration (Control | Limit Lines | Limits) GSM900

Setup: P/t 8PSK Multislot

- P/t 8PSK Multislot
  - Default Settings ✓
  - Ref.Power Mode: Current
- P/t Normal GMSK
  - Default Settings ✓
  - Repetition: Continuous
  - Display Mode: Current
  - Stop Condition: None
  - Statistic Count: 100 Bursts
  - Filter: 500 kHz Gauss
  - Grid: On
- P/t Normal 8PSK
  - Default Settings ✓

Limit Line/Area 1

- Upper Limit Line
  - Area 1
    - Enable ×
    - Static: Time | Level rel. | Level abs.

Range	PCL from	to	Lower	Upper	Enable
1	Max	Max	-2.0 dB	+2.0 dB	×
2	0	2	-2.0 dB	+2.0 dB	×
3	3	15	-3.0 dB	+3.0 dB	×
4	16	31	-5.0 dB	+5.0 dB	×
5	---	---	---	---	
6			---	---	
7				---	
8	---	---	---	---	
9	---	---	---	---	
10					

Modulation Configuration (Control | Limits) GSM900

Setup: Ovw,EVM,ME,PE 8PSK

- Ovw,EVM,ME,PE 8PSK
  - Default Settings ✓
  - Ref.Power Mode: Current
- Overview 8PSK
  - Default Settings ✓
  - Repetition: Continuous
  - Stop Condition: None
  - Statistic Count: 100 Bursts
- EVM 8PSK
  - Default Settings ✓
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current

Modulation Configuration (Control | Limits) GSM900

Setup: Ovw, EVM, ME, PE 8PSK

- Ovw, EVM, ME, PE 8PSK
  - Default Settings ✓
  - 95th percentile EVM: + 5.0 %
  - 95th percentile ME: + 5.0 %
  - 95th percentile PE: + 5.0 °
  - Current & Max
    - Error Vector Magn. (Peak): + 17.7 %
    - Error Vector Magn. (RMS): + 12.5 %
    - Magnitude Error (Peak): + 17.7 %
    - Magnitude Error (RMS): + 12.5 %
    - Phase Err. Peak: + 20.0 °
    - Phase Err. RMS: + 5.0 °
    - Origin Offset: - 20.0 dB

GSM900 Power

Max. Level + 30.0 dBm | Low Noise | Freq. Offset + 0.000 kHz | Chan./Trg. Slot Offs. 65 / 0 | Current

16.96 dBm Avg.Burst Power (Cur.)
0.00 Sym Sym.Offset
--- TSC detected
100 Bursts Statistic Count
--- Out of Tolerance

GSM900 Modulation

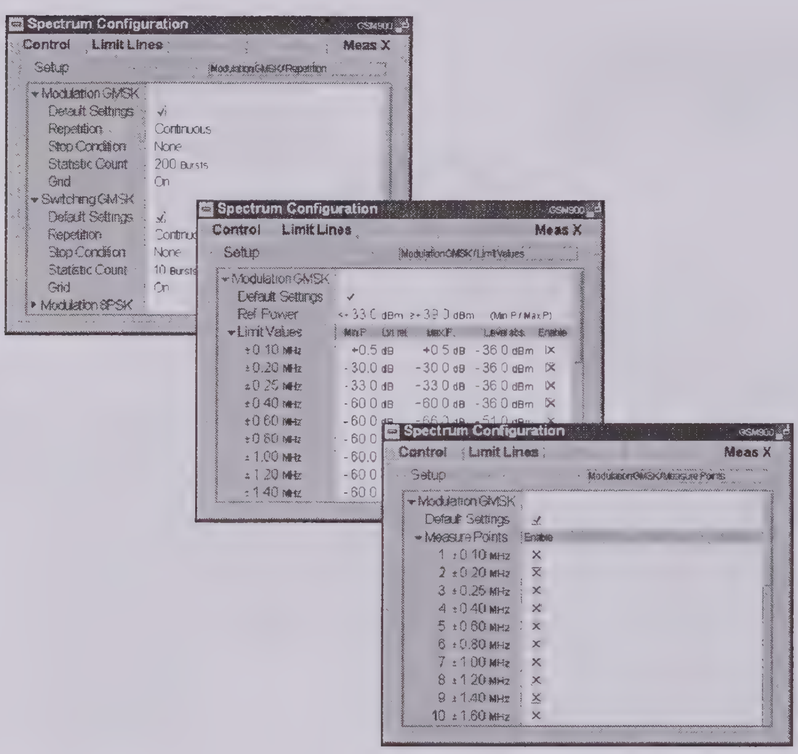
RF Level + 30.0 dBm | Low Dist. | Freq. Offset -103.876 kHz | Chan./Freq. 62 / 902.4 MHz | Current

GSM - 3 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg.Burst Power (Cur)
100 Bursts Statistic Count
33.45 % Bursts out of Tolerance

GSM-MS Non Signalling – Spectrum



Modulation GMSK/Repetition

- Modulation GMSK
  - Default Settings ✓
  - Repetition Continuous
  - Stop Condition None
  - Statistic Count 200 Bursts
  - Grid On
- Switching GMSK
  - Default Settings ✓
  - Repetition Continu
  - Stop Condition None
  - Statistic Count 10 Burst
  - Grid On
- Modulation 8PSK

Modulation GMSK/Limit Values

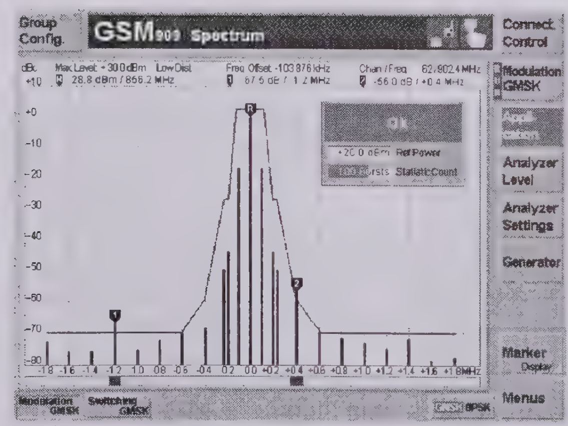
- Modulation GMSK
  - Default Settings ✓
  - Ref Power <+33.0 dBm ≥+39.0 dBm (Min P / Max P)
  - Limit Values

	Min P.		Max P.	Level abs.	Enable
±0.10 MHz	+0.5 dB		+0.5 dB	-36.0 dBm	☒
±0.20 MHz	-30.0 dB		-30.0 dB	-36.0 dBm	☒
±0.25 MHz	-33.0 dB		-33.0 dB	-36.0 dBm	☒
±0.40 MHz	-60.0 dB		-60.0 dB	-36.0 dBm	☒
±0.60 MHz	-60.0 dB		-66.0 dB	-51.0 dBm	☒
±0.80 MHz	-60.0				
±1.00 MHz	-60.0				
±1.20 MHz	-60.0				
±1.40 MHz	-60.0				

Modulation GMSK/Measure Points

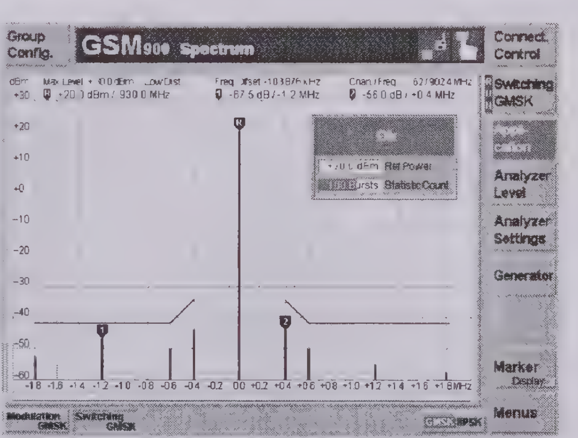
- Modulation GMSK
  - Default Settings ✓
  - Measure Points Enable

	Enable
1 ±0.10 MHz	☒
2 ±0.20 MHz	☒
3 ±0.25 MHz	☒
4 ±0.40 MHz	☒
5 ±0.60 MHz	☒
6 ±0.80 MHz	☒
7 ±1.00 MHz	☒
8 ±1.20 MHz	☒
9 ±1.40 MHz	☒
10 ±1.60 MHz	☒



Max Level +30.0 dBm Low Dist
R 28.8 dBm / 866.2 MHz
Freq Offset -103.876 kHz
1 -67.5 dB / -1.2 MHz
Chan / Freq 62 / 902.4 MHz
2 -56.0 dB / +0.4 MHz

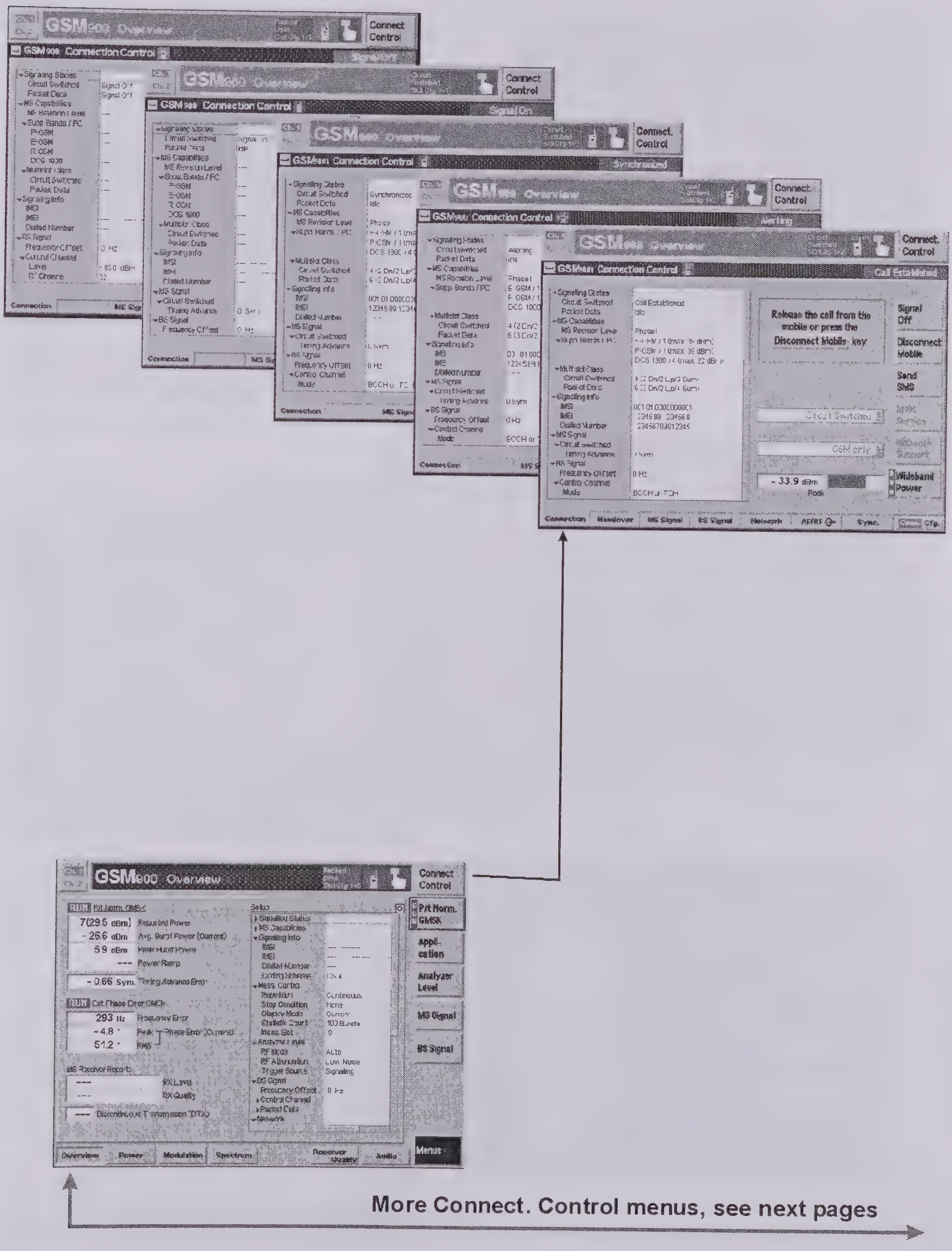
+20.0 dBm Ref Power
100 Bursts Statistic Count



Max Level +30.0 dBm Low Dist
R +20.0 dBm / 930.0 MHz
Freq Offset -103.876 kHz
1 -67.5 dB / -1.2 MHz
Chan / Freq 62 / 902.4 MHz
2 -56.0 dB / +0.4 MHz

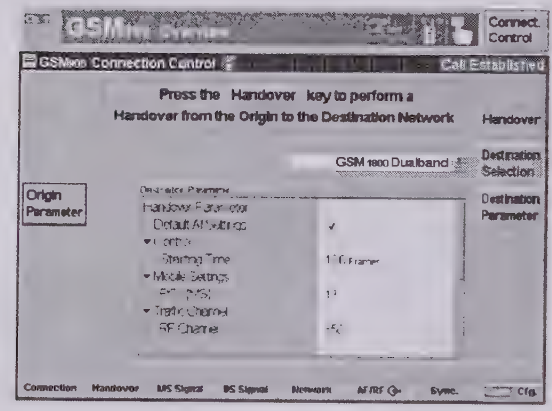
+20.0 dBm Ref Power
10 Bursts Statistic Count

GSM-MS Signalling – General Configurations I

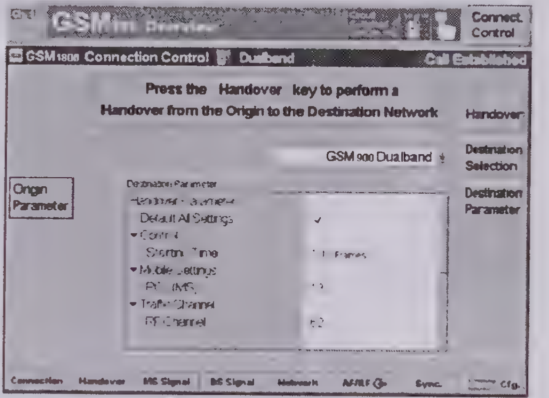


More Connect. Control menus, see next pages

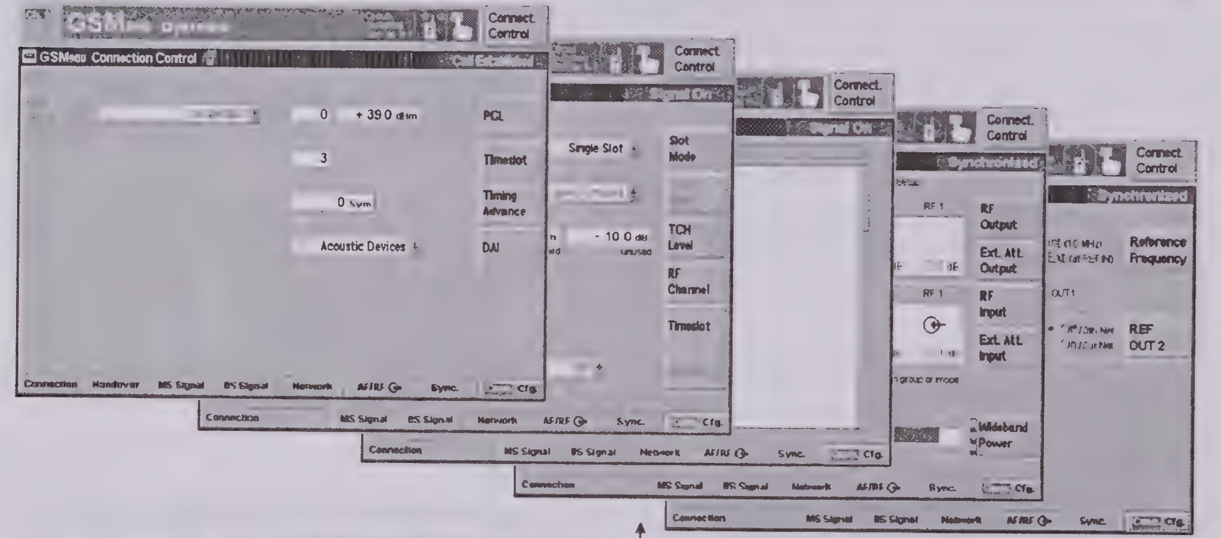
GSM-MS Signalling – General Configurations II

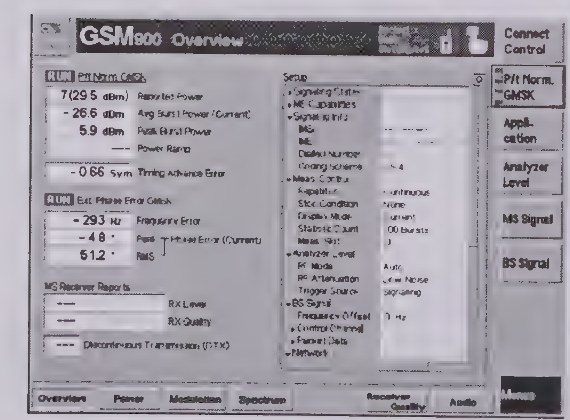


Press the Handover key to perform a Handover from the Origin to the Destination Network



Press the Handover key to perform a Handover from the Origin to the Destination Network





Measurement menus, see next pages

1 Installation and First Steps

This chapter describes how to install, update or enable software options *GSM400/850/900/1800/1900-MS* for the Universal Radio Communication Tester CMU200.

Before proceeding to perform any of the steps described in this manual, please make sure that the instrument is properly connected and put into operation according to the instructions given in chapter 1 of the CMU200 manual. The hardware and software options available are shown in the *Startup* menu. The status of the software options required for GSM mobile tests is indicated in the lines *CMU-K20 GSM400-MS, CMU-K21 GSM900-MS, CMU-K22 GSM1800-MS, CMU-K23 GSM1900-MS, CMU-K24 GSM850-MS,* and *CMU-K42 GPRS for GSM MS:*

- If a version number is indicated, the CMU is ready to perform GSM mobile tests. In this case you may skip this chapter, except if you wish to update the current software version or activate another version.
- If *disabled* is indicated, the software option must be enabled using a key code; see section *Creating a new Software Configuration* on page 1.4.
- If *not installed* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive, see below.

Software Installation or Update

The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate memory card CMU-Z1, order no. 1100.7490.02, can be obtained from Rohde & Schwarz.

Note: *If your CMU is equipped with a floppy disk drive (option CMU-U61), a set of installation floppy disks must be generated instead of a flash disk. All other steps do not depend on the storage medium.*

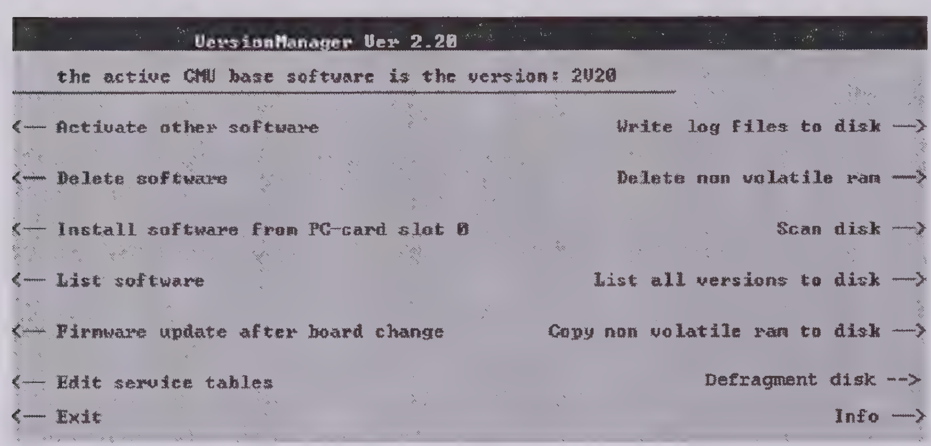
The five software options *GSM400/850/900/1800/1900-MS* and the supplementary option *GPRS for GSM MS (CMU-K42)* are part of a single software package termed *GSM MS*, so they must be installed or updated together. They can be enabled and operated separately, see section *Enabling Software Options* on page 1.6. To install the GSM MS software proceed as follows:

➢ Switch off the CMU.

➢ Insert the flash disk into one of the two slots of the PCMCIA interface.

➢ Switch on the CMU.

The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*


VersionManager Ver 2.20

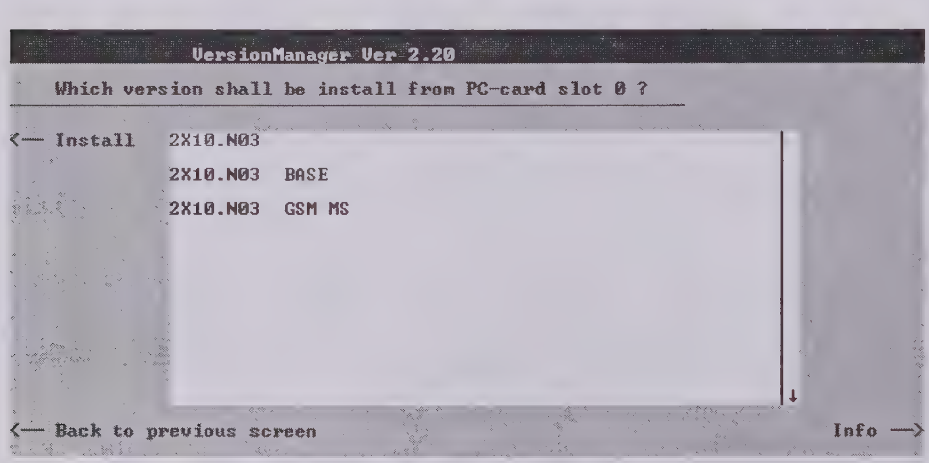
the active CMU base software is the version: 2V20

<— Activate other software
Write log files to disk —>
<— Delete software
Delete non volatile ram —>
<— Install software from PC-card slot 0
Scan disk —>
<— List software
List all versions to disk —>
<— Firmware update after board change
Copy non volatile ram to disk —>
<— Edit service tables
Defragment disk -->
<— Exit
Info —>

Softkey no. 5 on the left softkey bar, *Install software...*, is used to install new software from an external storage medium. The CMU automatically recognizes the storage medium and indicates the corresponding slot number: Slot 0 or 1 denotes the left or right slot of the PCMCIA interface. If a floppy disk is used the menu option reads *Install software version <version> from floppy*.

➢ Press left softkey no. 5 *(Install software...)* to start the installation.

If your storage medium contains several installation versions, the software version selection dialog is opened:


VersionManager Ver 2.20

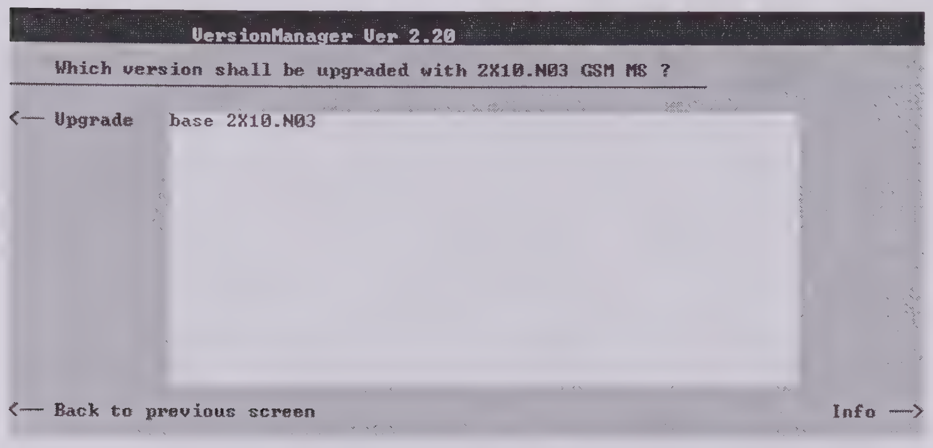
Which version shall be install from PC-card slot 0 ?

```
2X10.N03
2X10.N03   BASE
2X10.N03   GSM MS
```

➢ Use the rotary knob or the cursor keys to scroll the list and select the GSM MS version you intend to install.

➢ Press *Install* to start the installation.

The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. If none of the configurations is compatible to the new GSM MS option, the *VersionManager* displays an error message and takes you back to the software selection dialog; see section *Creating a new Software Configuration* on page 1.4. Otherwise, the following upgrade selection dialog is opened:

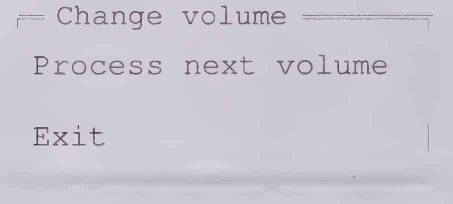


```
VersionManager Ver 2.20
Which version shall be upgraded with 2X10.N03 GSM MS ?

<— Upgrade    base 2X10.N03

<— Back to previous screen                                   Info —>
```

The upgrade selection dialog displays a list of base software versions that can be combined with the new GSM MS software.

- ➢ Select the appropriate base version and press *Upgrade*.

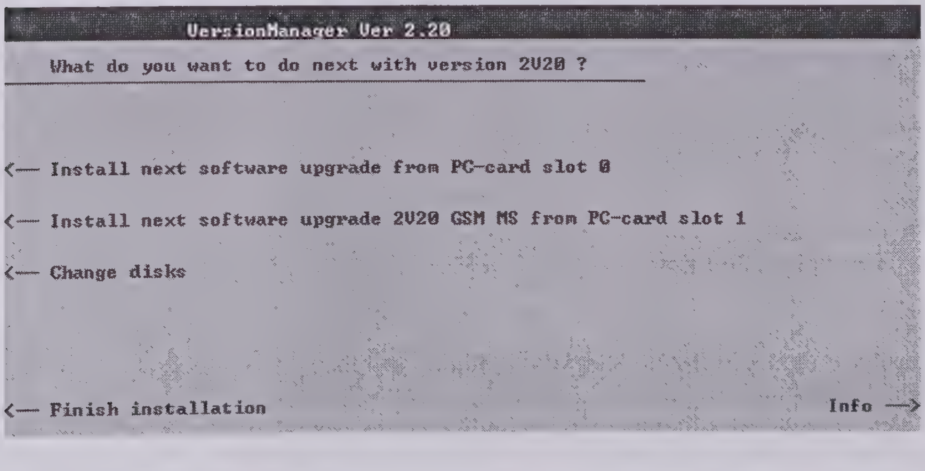
The new GSM MS option is added to the configuration or updates the previous GSM MS version of the configuration. To indicate that the storage medium must be changed the CMU issues the *Change volume* message:



```
Change volume
Process next volume

Exit
```

- ➢ Replace the current disk with the disk requested.
- ➢ Use the cursor up/down keys to select “Process next volume” (default setting).
- ➢ Press *ENTER* to confirm that the new disk has been inserted and to continue the installation.

After processing the last disk the CMU displays the following screen:



```
VersionManager Ver 2.20
What do you want to do next with version 2V20 ?

<— Install next software upgrade from PC-card slot 0

<— Install next software upgrade 2V20 GSM MS from PC-card slot 1

<— Change disks

<— Finish installation                                       Info —>
```

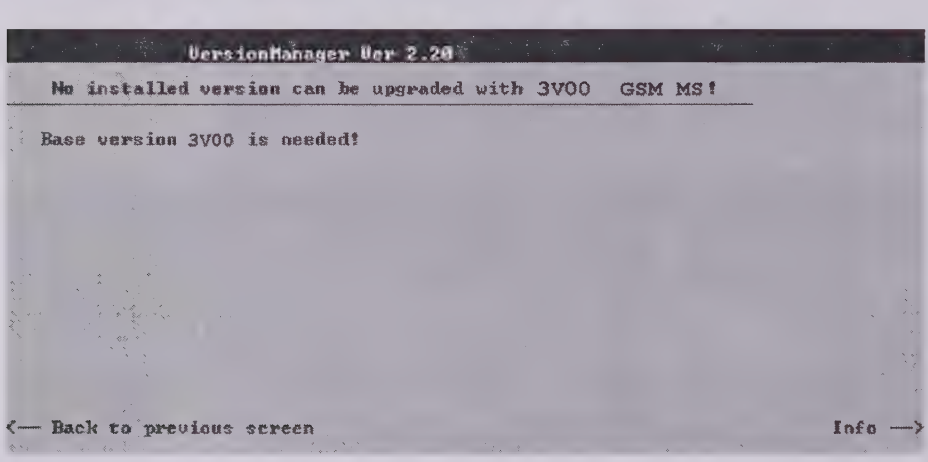
- ➢ If you wish to install or upgrade other software versions, press left softkey no 4 or 5 *(Install next software...)* or insert new storage medium into the PCMCIA slot or floppy disk drive and press *Change disks*.
- ➢ To finish the installation, remove all disks from the drive and press *Finish installation*.

The *VersionManager* is closed and the CMU is rebooted. The new firmware options are now operational and listed in the *Menu Select* menu together with their version number. Besides, the last software configuration installed is automatically taken as the active one in the next measurement session.

Creating a new Software Configuration

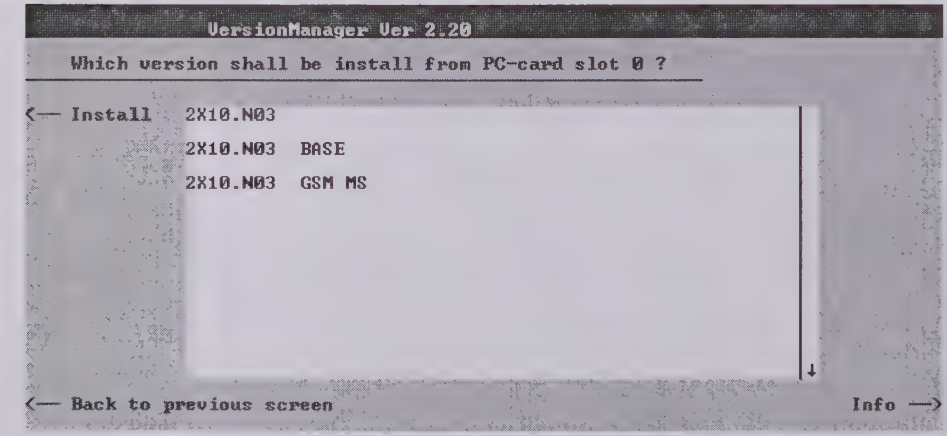
The CMU handles base software versions and network options on a separate basis. Different versions of the base software can be combined with different options to create new firmware configurations. For example, it is possible to update the base software without affecting the associated network options or vice versa. Moreover, the same base software version can be installed several times and combined with different network options (and vice versa), so it may enter into several firmware configurations.

If no compatible base software version can be found on the hard disk, then the CMU will refuse to install a new GSM MS software option selected in the software selection dialog (see previous section). Instead, it displays the following error message:



```
VersionManager Ver 2.20
No installed version can be upgraded with 3V00   GSM MS!

Base version 3V00 is needed!
```

➢ Press *Back to installation* to return to the software version selection dialog.

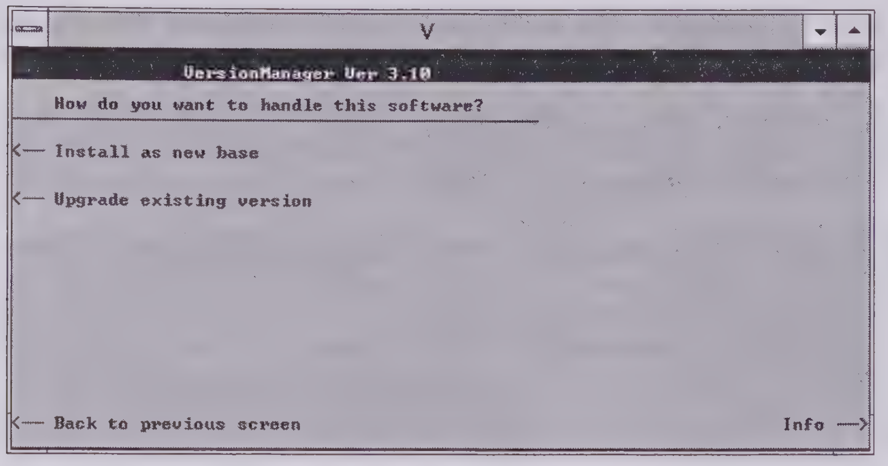


```
VersionManager Ver 2.20
Which version shall be install from PC-card slot 0 ?

2X10.N03
2X10.N03  BASE
2X10.N03  GSM MS
```

➢ Select a base software version that is compatible to your GSM MS software option and press *Install*.

Note: *The GSM MS firmware version number must be identical to the base software version number.*

With a new base software version, it is possible to either update an existing configuration or create a new one. A dialog selecting between the two alternatives is opened:

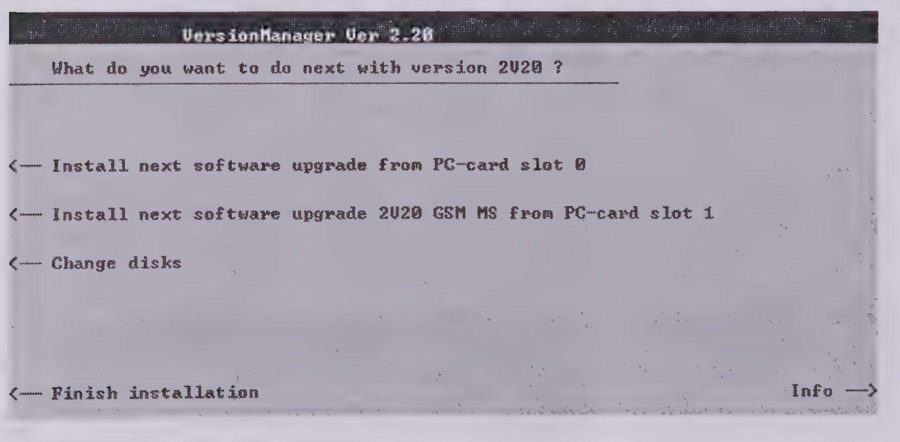


```
V
VersionManager Ver 3.10
How do you want to handle this software?

<— Install as new base

<— Upgrade existing version

<— Back to previous screen                              Info —>
```

Note: *This dialog is skipped if the new base software version is not compatible with any of the existing configurations. An incompatible new base software must be installed as a new base software.*

- ➢ If you wish to add a new configuration to your hard disk, press *Install as new base.*
- ➢ To upgrade an existing configuration with the selected base software version in order to make it compatible to the new GSM MS software option, press *Upgrade existing version*. The existing version to be upgraded must be selected in an additional dialog.

The installation is performed as described in section *Software Installation or Update*. After adding the new base software as a new configuration or updating the existing configuration, the CMU displays the following screen:



```
VersionManager Ver 2.20
What do you want to do next with version 2020 ?

<— Install next software upgrade from PC-card slot 0

<— Install next software upgrade 2020 GSM MS from PC-card slot 1

<— Change disks

<— Finish installation                              Info —>
```

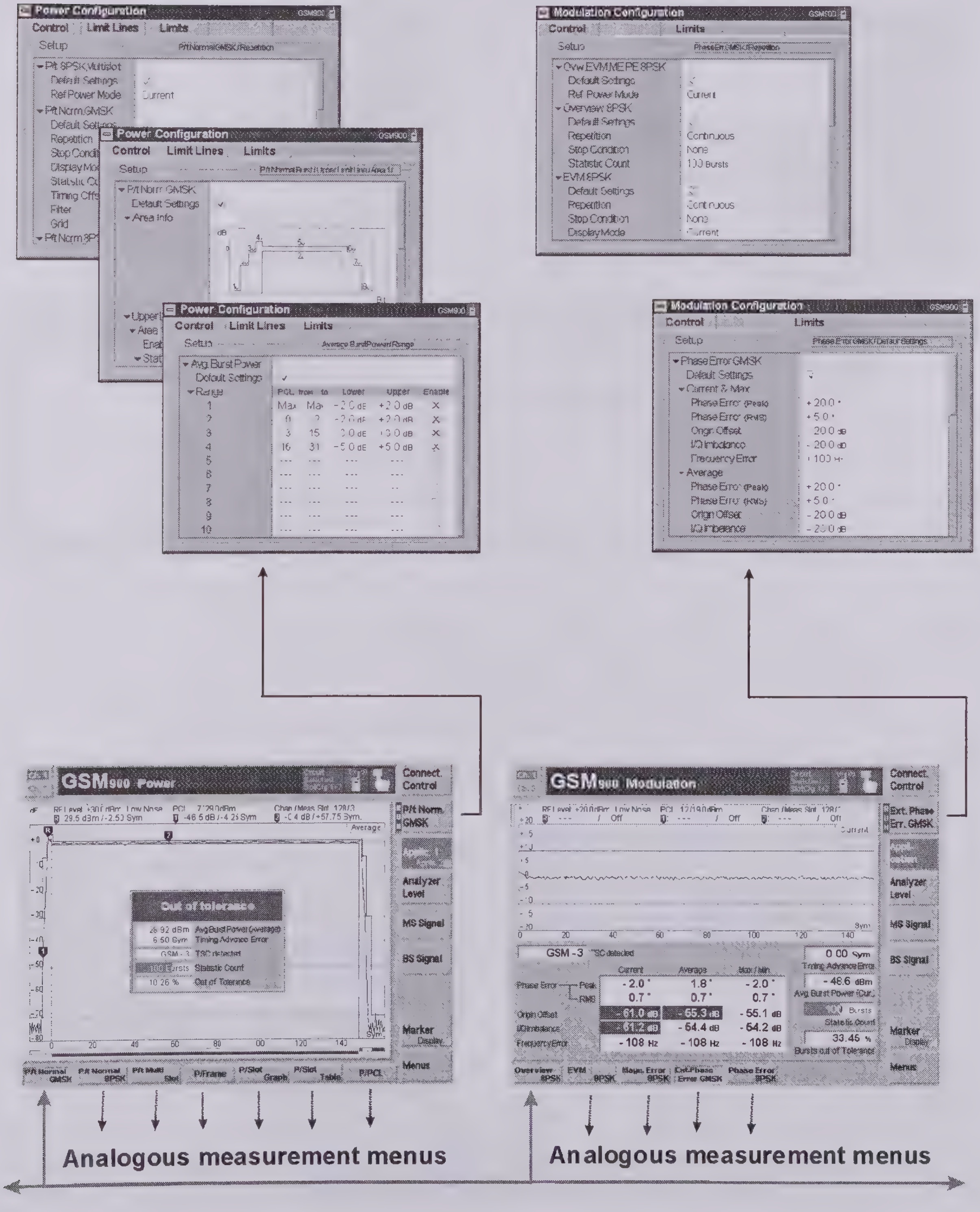
- ➢ Press left softkey no 4 or 5 *(Install next software...)* and proceed as described in section *Software Installation or Update* to install the new GSM MS version and assign it to the new configuration.

Enabling Software Options

A new CMU software option purchased is ready to operate after it is enabled by means of a key code supplied with the option. This key code is to be entered into the *Option Enable* popup window which in turn can be opened via from the *Setup – Options* menu. For details refer to Chapter 4 of the CMU200 operating manual.

Note: *The five software options* GSM400/850/900/1800/1900-MS *and the supplementary option* GPRS for GSM MS (CMU-K42) *are part of a single software package termed* GSM MS, *so they must be installed or updated together. However, they must be enabled and operated separately. Software installation and enabling of software options are completely independent from each other.*

GSM-MS Signalling – Power and Modulation



Power Configuration – Setup: P/t Normal GMSK / Repetition

- P/t 8PSK Multislot
  - Default Settings: ✓
  - Ref Power Mode: Current
- P/t Norm.GMSK
  - Default Settings
  - Repetition
  - Stop Condition
  - Display Mode
  - Statistic Count
  - Timing Offset
  - Filter
  - Grid
- P/t Norm.8PSK

Power Configuration – Setup: P/t Normal Burst / Upper Limit Line / Area 1

- P/t Norm GMSK
  - Default Settings: ✓
  - Area Info

Power Configuration – Setup: Average Burst Power / Range

- Avg. Burst Power
  - Default Settings: ✓
  - Range

Range	PCL from	to	Lower	Upper	Enable
1	Max	Max	-2.0 dB	+2.0 dB	X
2	0	2	-2.0 dB	+2.0 dB	X
3	3	15	-3.0 dB	+3.0 dB	X
4	16	31	-5.0 dB	+5.0 dB	X
5	---	---	---	---	
6	---	---	---	---	
7	---	---	---	---	
8	---	---	---	---	
9	---	---	---	---	
10	---	---	---	---	

Modulation Configuration – Setup: PhaseErr.GMSK / Repetition

- Ovw.EVM,ME,PE 8PSK
  - Default Settings: ✓
  - Ref. Power Mode: Current
- Overview 8PSK
  - Default Settings: ✓
  - Repetition: Continuous
  - Stop Condition: None
  - Statistic Count: 100 Bursts
- EVM 8PSK
  - Default Settings: ✓
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current

Modulation Configuration – Setup: Phase Error GMSK / Default Settings

- Phase Error GMSK
  - Default Settings: ✓
  - Current & Max
    - Phase Error (Peak): +20.0 °
    - Phase Error (RMS): +5.0 °
    - Origin Offset: -20.0 dB
    - I/Q Imbalance: -20.0 dB
    - Frequency Error: +100 Hz
  - Average
    - Phase Error (Peak): +20.0 °
    - Phase Error (RMS): +5.0 °
    - Origin Offset: -20.0 dB
    - I/Q Imbalance: -20.0 dB

GSM900 Power

RF Level +30.0 dBm Low Noise PCL 7/29.0 dBm Chan./Meas.Slot 128/3
R 29.5 dBm / -2.50 Sym 1 -46.5 dB / -4.25 Sym 2 -0.4 dB / +57.75 Sym.

Out of tolerance

26.92 dBm Avg.Burst Power (average)
6.50 Sym Timing Advance Error
GSM - 3 TSC detected
100 Bursts Statistic Count
10.26 % Out of Tolerance

GSM900 Modulation

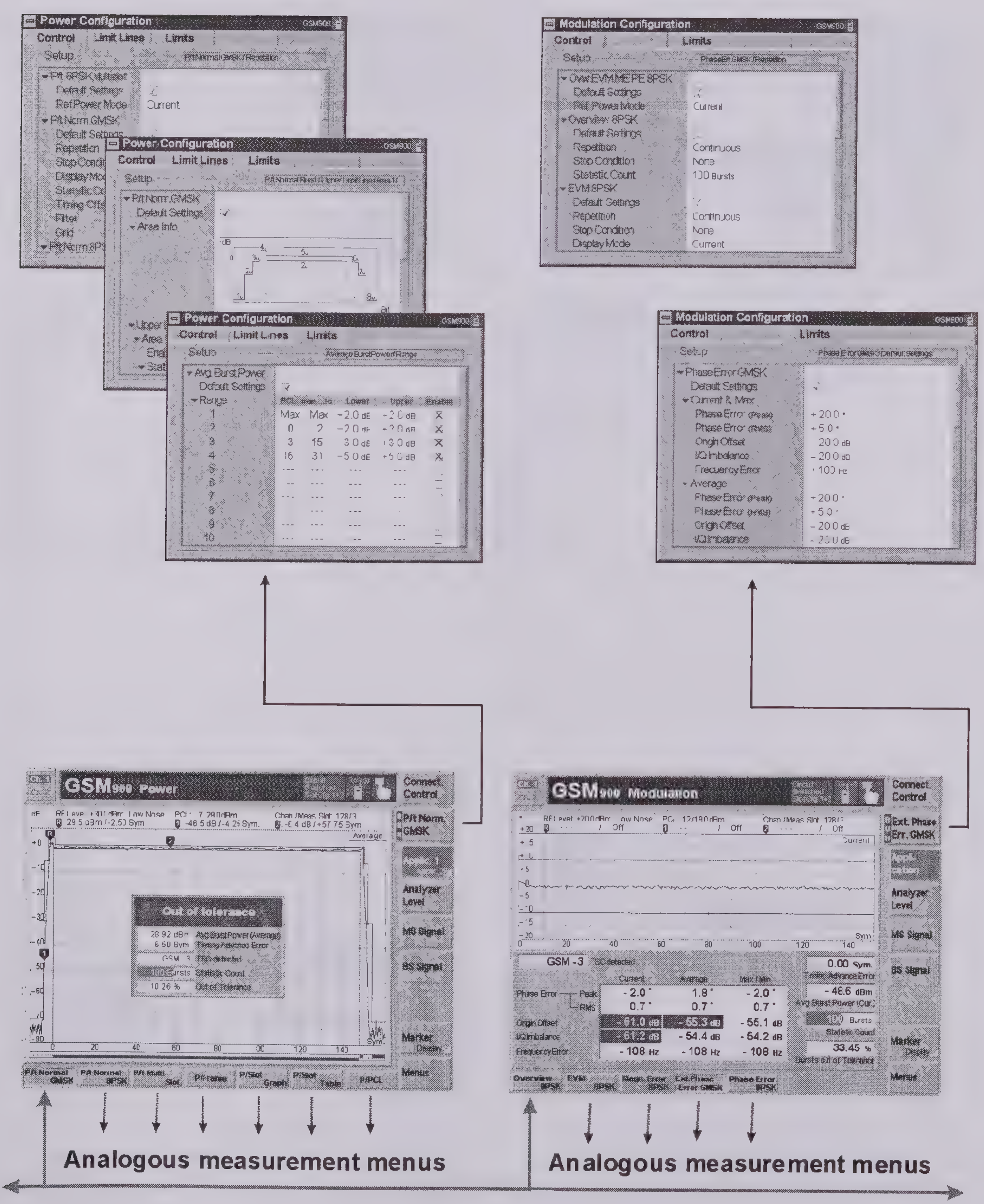
RF Level +20.0 dBm Low Noise PCL 12/19.0 dBm Chan./Meas.Slot 128/
R: --- / Off 1: --- / Off 2: --- / Off

GSM - 3 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	-2.0 °	1.8 °	-2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		-61.0 dB	-55.3 dB	-55.1 dB
I/Q Imbalance		-61.2 dB	-64.4 dB	-64.2 dB
Frequency Error		-108 Hz	-108 Hz	-108 Hz

0.00 Sym Timing Advance Error
-48.6 dBm Avg. Burst Power (Cur.)
Bursts Statistic Count
33.45 % Bursts out of Tolerance

GSM-MS Signalling – Spectrum and Receiver Quality



- P/t 8PSK Multislot
  - Default Settings ✓
  - Ref.Power Mode Current
- P/t Norm.GMSK
  - Default Settings
  - Repetition
  - Stop Condi…
  - Display Mo…
  - Statistic Co…
  - Timing Offs…
  - Filter
  - Grid
- P/t Norm.8PS…

- P/t Norm.GMSK
  - Default Settings ✓
  - Area Info
- Upper L…
  - Area
    - Enal…
  - Stat…

- Avg.Burst Power
  - Default Settings ✓
  - Range

Range	PCL from	to	Lower	Upper	Enable
1	Max	Max	-2.0 dB	+2.0 dB	☒
2	0	2	-2.0 dB	+2.0 dB	☒
3	3	15	-3.0 dB	+3.0 dB	☒
4	16	31	-5.0 dB	+5.0 dB	☒
5	---	---	---	---	☐
6	--	---	---	---	☐
7	---	---	---	---	☐
8		---	---		
9	---	---	---	---	☐
10	---	---	--	---	☐

- Ovw.EVM.ME.PE 8PSK
  - Default Settings ✓
  - Ref. Power Mode Current
- Overview 8PSK
  - Default Settings ✓
  - Repetition Continuous
  - Stop Condition None
  - Statistic Count 100 Bursts
- EVM 8PSK
  - Default Settings ✓
  - Repetition Continuous
  - Stop Condition None
  - Display Mode Current

- Phase Error GMSK
  - Default Settings ✓
  - Current & Max
    - Phase Error (Peak) +20.0 °
    - Phase Error (RMS) +5.0 °
    - Origin Offset -20.0 dB
    - I/Q Imbalance -20.0 dB
    - Frequency Error +100 Hz
  - Average
    - Phase Error (Peak) +20.0 °
    - Phase Error (RMS) +5.0 °
    - Origin Offset -20.0 dB
    - I/Q Imbalance -20.0 dB

RF Level +30.0 dBm Low Noise PCL 7 29.0 dBm Chan./Meas.Slot 128/3
R 29.5 dBm / -2.50 Sym 1 -46.5 dB / -4.25 Sym. 2 -0.4 dB / +57.75 Sym

28.92 dBm	Avg.Burst Power (Average)
6.50 Sym	Timing Advance Error
GSM 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

RF Level +20.0 dBm Low Noise PCL 12/19.0 dBm Chan./Meas.Slot 128/3
R --- / Off 1 --- / Off 2 --- / Off

GSM -3 TSC detected

		Current	Average	Max/Min
Phase Error	Peak	-2.0 °	1.8 °	-2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		-61.0 dB	-55.3 dB	-55.1 dB
I/Q Imbalance		-61.2 dB	-54.4 dB	-54.2 dB
Frequency Error		-108 Hz	-108 Hz	-108 Hz

0.00 Sym.	Timing Advance Error
-48.6 dBm	Avg.Burst Power (Curr.)
100 Bursts	Statistic Count
33.45 %	Bursts out of Tolerance

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4 Functions and their Application

This chapter explains in detail all functions for the measurement of mobile stations supporting the GSM standard.

The chapter is divided in two sections corresponding to the two function groups for module tests *(GSM400/850/900/1800/1900-MS Non Signalling)* and for mobile tests including signalling *(GSM400/850/900/1800/1900-MS Signalling)*. Within the two sections, the discussion is structured according to the provided measurements and configurations (see graphical overview at the end of chapter 3). In contrast to chapter 6, *Remote Control – Commands,* general measurement configurations are relegated to the end of each section.

The description of each softkey, select or input field is followed by the corresponding remote-control commands. Similarly, the description of the commands in chapter 6 also contains the corresponding menus of the user interface.

Each menu and each panel is briefly described first and then illustrated together with its call button. The menu functions are explained according to the following scheme:

Softkey Short function definition

Designation of select/input field

Definition of field function.

Further description of the field: purpose, interaction with other settings, notes...

Parameter 1	Description of parameter 1
Parameter 2	Description of parameter 2

...

Further description of the parameters: purpose, interaction with other settings, notes...

Remote control

```
Remote-control command (long form)  Parameter1 | Parameter2
...
```

For all numerical values, including their ranges and default settings, please refer to the description of the remote-control commands in chapter 6.

The description of the operating concept is to be found in chapter 3 of the operating manual for the CMU basic instrument; besides, a description of measurement control and the essential settings is given in chapter 3 in the present GSM manual. A comprehensive index listing important keywords and the proper names of all menus, dialog elements and softkeys is appended to the end of this manual.

GSM Module Tests (Non Signalling)

The structure of this section is based on the configuration and measurement groups in function group *GSM400/850/900/1800/1900-MS Non Signalling*, i.e. the menus of the graphical user interface. The menus are described in the following order:

1. Overview of fundamental test settings and measurement results *(Analyzer/Generator* menu)
2. Measurement menus *Power, Modulation,* and *Spectrum:* Purpose of the measurements and relation to the test specifications and conformance requirements, description of measurement results, specific measurement configurations
3. General device configurations *(Connection Control)*

The most important menus within function group *GSM400/850/900/1800/1900-MS Non Signalling* are shown in an overview at the end of chapter 3 in the present GSM manual.

Analyzer/Generator Menu

The *Analyzer/Generator* menu displays the essential results of the *P/t Norm. GMSK,* the *Ext. Phase Err. GMSK*, and the *Overview 8PSK* applications and provides access to the most important measurement settings. In particular, it configures the signals of the RF generator and defines the properties of the CMU's RF analyzer.

- The measurement control softkey *P/t Norm. GMSK* changes to *Ext. Phase Err. GMSK* or *Overview 8PSK,* depending on the application selected. This softkey controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration* or *Modulation Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* or *Modulation* measurement.
- The other softkeys on the right side are combined with various hotkeys (e.g. the hotkeys *Template PCL, Frequency, Channel, Frequency Offset,* and *Training Sequence* belong to the softkey *Analyzer Settings).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

Types of settings

The purpose of the *Analyzer/Generator* menu is to provide quick access to the most common *Power* and *Modulation* measurements and to present the basic measurement results at a glance. The three measurement applications *P/t Norm. GMSK,* the *Ext. Phase Err. GMSK*, or *Overview 8PSK* can be selected with the *Application* softkey. The remaining softkeys/hotkey combinations provide two different types of settings:

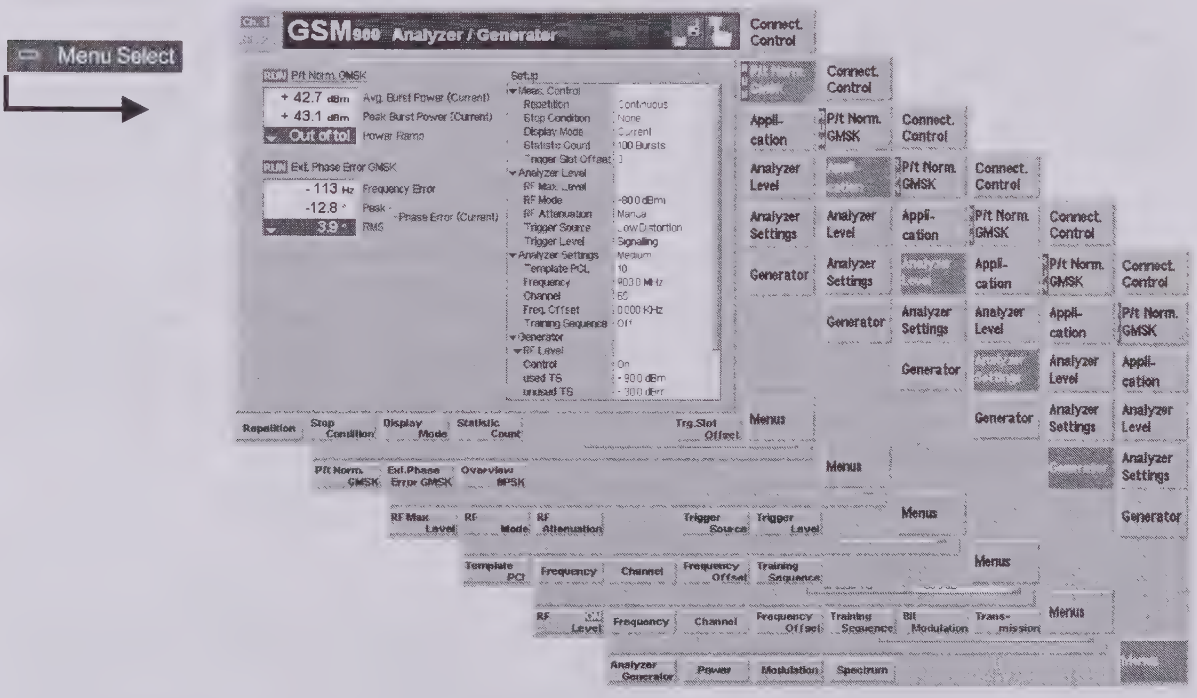
- General settings are valid for all applications of function group *GSM400/850/900/1800/1900-MS Non Signalling.* Changing general settings in an arbitrary application will have an impact on all measurements and applications of the function group. All general settings are also provided in the *Connection Control* menu (see p. 4.66 ff.). Examples of general settings are the RF input level and trigger settings (softkey *Analyzer Level)* and the configuration of the RF generator (softkey *Generator).*
- Specific settings are relevant for one application only, or they can be set independently for several applications. Changing specific settings in an application will not affect the other measurements and applications of the function group. No specific settings are provided in the *Connection Control* menu (see p. 4.66 ff.). Examples of specific settings are the *Repetition* mode (to be set independently for all applications) and *Template PCL* (relevant for the *P/t Norm. GMSK* application only).

Measurement results

The output fields in the left half of the *Analyzer/Generator* menu show the current measurement results. The results depend on the application selected. They are described in detail in section *Measurement Results* on p. 4.6 f.

The results displayed in the *Analyzer/Generator* menu represent only a small fraction of the power and modulation results that the CMU is able to acquire. A comprehensive set of test results is displayed in the *Power* and *Modulation* measurement menus; see sections *Power Measurements* on p. 4.8 ff. and *Modulation Measurements* on p. 4.37 ff. In particular, the *Power* and *Modulation* menus show many quantities as functions of time

The *Analyzer/Generator* menu can be opened from the *Menu Select* menu (with associated key at the front of instrument). The hotkeys associated to the *Menus* softkey switch over between the *Analyzer/Generator* menu and the remaining measurement menus of function group *GSM400/850/900/1800/1900-MS Non Signalling*.



P/t Norm. GMSK
+ 42.7 dBm Avg. Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)
Out of tol Power Ramp

Ext. Phase Error GMSK
- 113 Hz Frequency Error
-12.8 ° Peak
3.9 ° RMS
Phase Error (Current)

Setup
Meas. Control
Repetition Continuous
Stop Condition None
Display Mode Current
Statistic Count 100 Bursts
Trigger Slot Offset 0
Analyzer Level
RF Max. Level
RF Mode -80.0 dBm
RF Attenuation Manual
Trigger Source Low Distortion
Trigger Level Signalling
Analyzer Settings Medium
Template PCL 10
Frequency 903.0 MHz
Channel 65
Freq. Offset 0.000 KHz
Training Sequence Off
Generator
RF Level
Control On
used TS - 90.0 dBm
unused TS - 30.0 dBm

Fig. 4-1 Measurement menu Analyzer/Generator (example: GMSK modulation)

Test Settings

The settings for the *Analyzer/Generator* menu are accessible via softkey/hotkey combinations. If a softkey (located in the softkey bar on the right side of the menu) is selected and an associated hotkey (displayed across the bottom of the menu) is pressed, a popup window indicating the current setting and enabling an entry will appear.

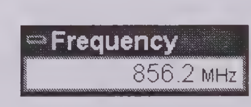
Example:

Analyzer Settings

The *Analyzer Settings* softkey displays a hotkey bar including the hotkey labeled *Frequency*.

Frequency

The *Frequency* hotkey opens the input window *Frequency*.



Frequency

856.2 MHz

Input windows indicate the current parameter value (in this case: the current RF input frequency) or a list of the possible settings. Parameters are changed by

- Overwriting/incrementing numerical values (for numerical parameters)
- Selecting from the list of parameters (for select parameters)

Measurement Control

Each *Analyzer/Generator* application is controlled by means of the measurement control softkey (measurement control softkey) below the *Connect. Control* softkey and the associated hotkeys.

P/t Norm. GMSK

The *P/t Norm. GMSK* softkey (which changes to *Ext. Phase Err. GMSK* or *Overview 8PSK*, depending on the application selected) controls the measurement application and indicates its status *(RUN | HLT | OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status can be set independently for all three applications.

The applications *P/t Norm. GMSK* and *Ext. Phase Err. GMSK* can be run in parallel, so the results for both applications are displayed simultaneously. Switchover between these two applications does not change the course of the measurement.

The GMSK applications and the *Overview 8PSK* suspend each other. The selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

`INITiate:POWer[:NORMal][:GMSK]` etc.
`FETCh:POWer[:NORMal][:GMSK]:STATus?`
`INITiate:MODulation:XPERror[:GMSK]` etc.
`FETCh:MODulation:XPERror[:GMSK]:STATus?`
`INITiate:MODulation:OVERview:EPSK` etc.
`FETCh:MODulation:OVERview:EPSK:STATus?`

Measurement configuration

The configuration menus for all *Power* and *Modulation* measurements are directly accessible from the *Analyzer/Generator* menu:

- Pressing the *P/t Norm. GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.27 ff.).
- Pressing the *Ext. Phase Err. GMSK* or the *Overview 8PSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.49 ff.).

Selecting the Application

Application

The *Application* softkey selects the measurement application. The measurement control softkey (second softkey below *Connect. Control)* indicates the current application. Some of the hotkeys associated to the different softkeys, the *Setup* table, and the results in the *Analyzer/Generator* menu also vary as a function of the application. The corresponding measurement results are explained in section *Measurement Results* on page 4.6 ff.

P/t Normal GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for normal burst signals. See section *Power Measurements* on p. 4.8.

Remote control
The *P/t Normal GMSK* application is selected by the keywords `[:NORMal] [:GMSK]` in the 3rd and 4th level of the `POWer` commands, e.g.
`CONFigure:POWer [:NORMal][:GMSK]...`

Ext. Phase Err. GMSK

The *Ext. Phase Error GMSK* hotkey selects the measurement of the modulation accuracy of GMSK modulated signals. See section *Measurement Menu (Modulation – GMSK)* on p. 4.37.

Remote control
The *Phase Error GMSK* application is selected by the keywords `XPERror[:GMSK]` in the 3rd and 4th level of the `MODulation` commands, e.g.
`CONFigure:MODulation:XPERror[:GMSK]...`

Overview 8PSK

The *Overview 8PSK* hotkey selects the measurement of the power and modulation accuracy of 8PSK modulated signals. See section *Measurement Menu (Modulation – 8PSK)* on page 4.41.

Remote control
The *Overview 8PSK* application is selected by the keywords `OVERview:EPSK` in the 3rd and 4th level of the `MODulation` commands, e.g.
`CONFigure:MODulation:OVERview:EPSK...`

Application-Specific Settings

As outlined in section *Analyzer/Generator Menu* on p. 4.2, some of the hotkey/softkey combinations in the *Analyzer/Generator* menu vary as a function of the application. However, all *Analyzer/Generator* settings are always identical to the corresponding settings in the *Power* and *Modulation* menus. Changes made in the *Analyzer/Generator* menu overwrite the *Power* and *Modulation* settings and vice versa.

Description of settings

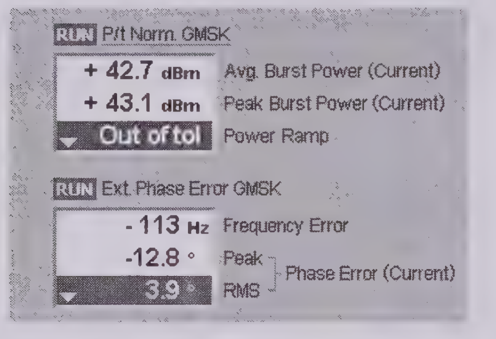
- The settings to be made in the *P/t Normal GMSK* application are described in section *P/t Normal GMSK* on p. 4.11 ff.
- The settings to be made in the *Ext. Phase Error GMSK* application are described in section *Test Settings* on p. 4.38 ff.
- The settings to be made in the *Overview 8PSK* application are described in section *Test Settings* on p. 4.44 ff.

Setup table

The *Setup* table in the right half of the *Analyzer/Generator* menu gives an overview of the measurement settings belonging to the current application. It changes when a different application is selected. The rollkey scrolls and expands the *Setup* table.

Measurement Results

The results displayed in the *Analyzer/Generator* menu depend on the selected application:



RUN P/t Norm. GMSK
+ 42.7 dBm Avg. Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)
Out of tol Power Ramp

RUN Ext. Phase Error GMSK
- 113 Hz Frequency Error
-12.8 ° Peak
3.9 ° RMS
Phase Error (Current)

The results for the *P/t Norm. GMSK* and *Ext. Phase Error GMSK* applications are displayed simultaneously because both applications can be run in parallel. The results appear in two output fields, each containing three entries. A header line indicates the name of the application and its measurement status. The current application is underscored.

All results refer to the current burst. No comparison is made between different bursts, so the result does not depend on the statistical settings (e.g. single shot or continuous measurement).

P/t Norm. GMSK The *P/t Norm. GMSK* output field indicates the average and peak burst power as well as the result of the limit check:

Avg. Burst Power (Current)	Average power of the current burst in dBm.
Peak Burst Power (Current)	Peak power of the current burst in dBm.
Power Ramp	Matching of the tolerances by the current burst. The messages that may appear in the list field are self-explanatory.

The *P/t Norm. GMSK* results are also indicated in the info box in the graphical measurement menu *Power* (see section *P/t Normal GMSK* on p. 4.20 ff.).

Remote control

```
READ[:SCALar]:POWer[:NORMal][:GMSK]?
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?
```

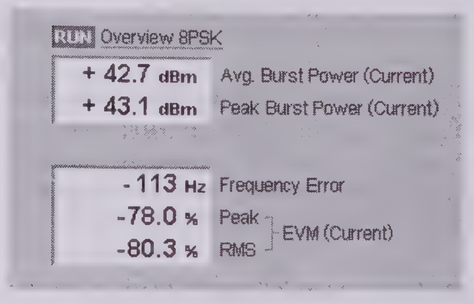
Ext. Phase Error GMSK The *Ext. Phase Error GMSK* output field indicates the average (RMS) and peak phase error and the frequency error:

Frequency Error	Frequency error of the current burst in Hz.
Peak Phase Error (Current)	Extreme value of the phase error (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative.
RMS Phase Error (Current)	RMS phase error of the current burst in degrees.

The *Ext. Phase Err. GMSK* results are also indicated in the graphical measurement menu *Modulation* (see section *Measurement Results* on p. 4.40 ff.). For a detailed explanation of the quantities characterizing the GMSK modulation accuracy see section *Measurement Menu (Modulation – GMSK)* on p. 4.37 f.

Remote control

```
READ[:SCALar]:MODulation:XPERror[:GMSK]?
FETCh[:SCALar]:MODulation:XPERror[:GMSK]?
SAMPle[:SCALar]:MODulation:XPERror[:GMSK]?
```



RUN Overview 8PSK

+ 42.7 dBm Avg. Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)

- 113 Hz Frequency Error
-78.0 % Peak EVM (Current)
-80.3 % RMS EVM (Current)

The results for the *Overview 8PSK* application appear in two output fields with two and three rows, respectively. A header line indicates the name of the application and its measurement status.

All results refer to the current burst. No comparison is made between different bursts, so the result does not depend on the statistical settings (e.g. single shot or continuous measurement).

Overview 8PSK The *Overview 8PSK* output fields indicate the average and peak burst power, the average (RMS) and peak Error Vector Magnitude (EVM) and the frequency error:

Avg. Burst Power (Current)	Average power of the current burst in dBm.
Peak Burst Power (Current)	Peak power of the current burst in dBm.
Frequency Error	Frequency error of the current burst in Hz.
Peak EVM (Current)	Extreme value of the Error Vector Magnitude (minimum or maximum, whichever has the larger absolute value) of the current burst in degrees. The result can be positive or negative.
RMS EVM (Current)	RMS-averaged EVM of the current burst in degrees. Quadratic averaging complies with the GSM standard.

The *Overview 8PSK* results are also indicated in the measurement menu *Modulation* (see section *Scalar Results (Overview)* on p. 4.46). For a detailed explanation of the quantities characterizing the 8PSK modulation accuracy see section *Measurement Menu (Modulation – 8PSK)* on p. 4.42 f.

Remote control

```
READ[:SCALar]:MODulation:OVERview:EPSK?
FETCh[:SCALar]:MODulation:OVERview:EPSK?
SAMPle[:SCALar]:MODulation:OVERview:EPSK?
```

Power Measurements

The menu group *Power* is designed to measure the RF output power of the MS transmitter. The power can be analyzed as a function of time in a single timeslot or in up to 4 consecutive timeslots. Furthermore, the CMU evaluates the average power and its evolution over several consecutive slots or frames. The different measurements are treated as different applications; the results are displayed in separate *Power* measurement menus. The popup menu *Power Configuration* is used to configure the measurements.

The different types of Power measurements are treated as applications which can be selected with the *Application* softkey.

P/t Normal

The *P/t Normal ...* (burst power versus time) application measures the output power of the DUT over one burst period. The measurement curve obtained can be further processed to determine an average, minimum, or maximum result and calculate the average over the whole burst. *P/t* measurements are provided for normal bursts at GMSK or 8MSK modulation.

In addition to the burst power measurement, a limit check with tolerances depending on the RF output power of the DUT and the modulation scheme is performed; see section *Limit lines (Power Configuration – Limit Lines)* on p. 4.31 ff.

P/t Multislot

The *P/t Multislot* application measures the output power of the DUT over up to 653 symbol periods, corresponding to 4 timeslots plus an appropriate display margin. This measurement is particularly suited to GSM multislot solutions like GPRS or circuit-switched HSCSD where several timeslots can be allocated to a single connection.

The multislot measurement curve can be further processed to determine an average, minimum, or maximum result and calculate the average power over each burst measured. *P/t Multislot* measurements are provided both in *Non Signalling* and in *Signalling* test mode and for normal bursts at GMSK and 8PSK modulation. In addition to the burst power measurement, a limit check with tolerances depending on the RF output power of the DUT and the modulation scheme is performed; see section *Limit lines (Power Configuration – Limit Lines)* on p. 4.31 ff.

P/Slot

The *P/Slot* applications measure the average burst power in a series of consecutive timeslots. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The result is displayed either in a bar graph (all eight timeslots of a single TDMA frame, *P/Slot Graph* application) or in a table (up to 512 timeslots, corresponding to a total test time of approx. 0.3 s, *P/Slot Table* application).

P/Frame

The *P/Frame* measurement represents a fast and convenient method of monitoring the behavior of the average burst power in a particular timeslot over a whole range of consecutive TDMA frames. The measurement extends over a range of 128 frames, corresponding to test times of less than 0.6 s. The average is obtained like in the case of *P/Slot* measurements.

The *P/Slot* and the *P/Frame* measurement complement the *P/t* measurement where a large number of bursts can be measured but the output of the average burst power is restricted to current, average, minimum or maximum values within a statistics cycle (see *Display Mode* setting below). *P/Slot and P/Frame* returns **all** values; the applications are suitable whenever the behavior or the stability of the average burst power in particular timeslots are to be monitored over an extended time range in R&D.

RF Level

In all applications, the CMU measures at arbitrary RF input levels provided that they are within the allowed range of the RF input connectors.

Signalling mode

Note: *In Signalling mode, where the CMU is able to test a broad range of signalling issues, two further measurement applications are available (see section* Power Measurements *on page 4.88 ff):*

The average burst power can be measured as a function of the PCL of the mobile phone (application P/PCL*).*

Access bursts from the mobile station can be measured (see also section Limit lines (Power Configuration – Limit Lines) *on page 4.31 ff.*

Measurement Menu (Power)

The graphical measurement menu *Power* shows the results of the burst analysis (power measurement).

- The measurement control softkey *P/t Norm. GMSK,* which changes to *P/t Norm. 8PSK, P/Frame etc.,* depending on the power measurement application and on the modulation scheme selected) controls the power measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the hotkeys *Template PCL, Frequency, Channel, Frequency Offset,* and *Training Sequence* belong to the softkey *Analyzer Settings).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Menus* softkey and the *Power* hotkey.

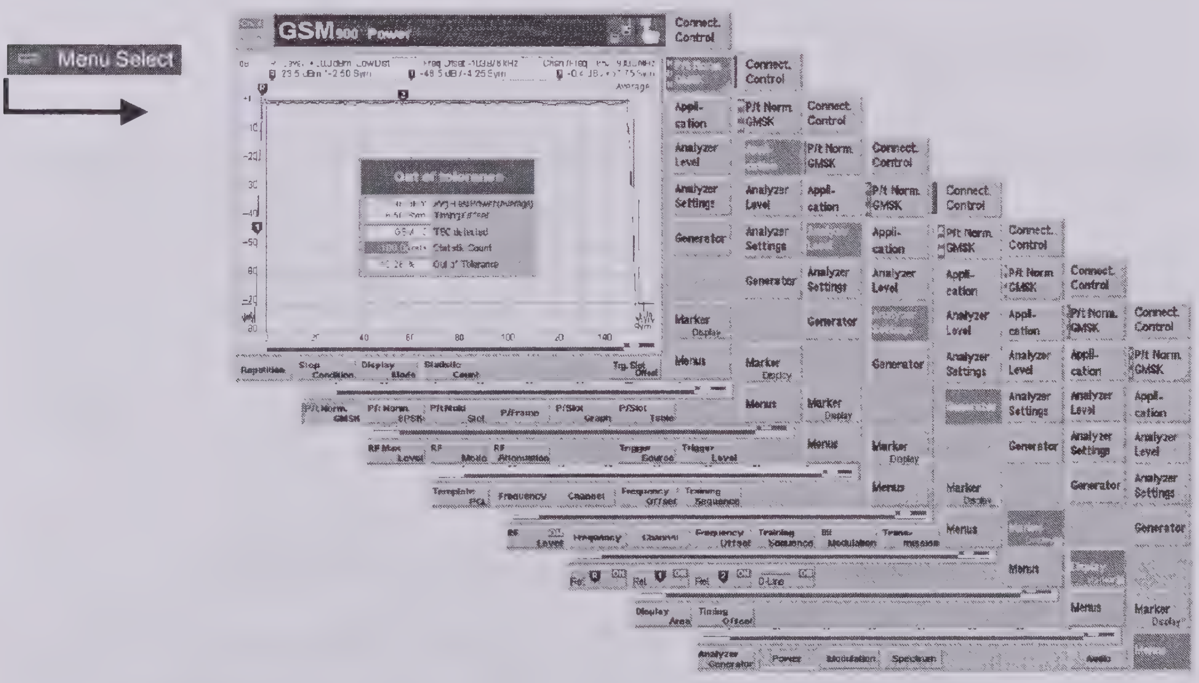


Fig. 4-2 Measurement menu Power – P/t Norm. GMSK

Test Settings

The basic settings for the *Power* measurement are directly accessible from the measurement menu via softkey/hotkey combinations. The entry of values is described in section *Test Settings* on page 4.3.

Many of the basic settings are also accessible from the Power Configuration popup menu. They are explained in more detail in the *Measurement Configurations (Power Configuration)* section on page 4.27 ff.

a) Measurement Control

Each *Power* application is controlled by means of the measurement control softkey below the *Connect. Control* softkey and the associated hotkeys.

P/t Norm. GMSK

The *P/t Norm. GMSK* measurement control softkey (which changes to P/t Norm. 8PSK etc., depending on the application selected) controls the power measurement application and indicates its status *(RUN | HLT | OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status can be set independently for all *Power* applications.

The active *Power* application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

```
INITiate:<Application>
ABORt:<Application>
STOP:<Application>
CONTinue:<Application>
FETCh:<Application>:STATus?
<Application> = POWer:NORMal[:GMSK] etc.
```

Measurement configuration

Pressing the *P/t Norm. GMSK* softkey twice opens the popup menu *Power Configuration* (see page 4.27). Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.27 ff.

b) Selecting the Measurement Application

Appli-cation

The Application softkey selects the power measurement application.

The applications *P/t Normal <Mod_Type>* depend on the modulation scheme of the analyzed signal. In the *P/t Multislot* application, the modulation in each measured slot can be defined separately. The *P/Frame, P/Slot Graph,* and *P/Slot Table* menus and settings do not depend on the modulation scheme.

The *Power* measurement menu and the measurement control softkey change with the application selected; the results are explained in section *Measurement Results* on page 4.19 ff.

P/t Normal GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for GMSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control:
The *P/t Normal GMSK* application is selected by the keywords `[:NORMal]` `[:GMSK]` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer[:NORMal][:GMSK]...`

P/t Normal 8PSK

The *P/t Normal 8PSK* hotkey selects the power versus time measurement for 8PSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control:
The *P/t Normal 8PSK* application is selected by the keywords `[:NORMal]:EPSK` in the 3rd and 4th level of the POWer commands, e.g. `CONFigure:POWer [:NORMal]:EPSK...`

P/t Multislot

The *P/t Multislot* hotkey selects the power versus time measurement for multislot configurations (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control:
The *P/t Multislot* application is selected by the 3rd level keyword `:MSLot` in the POWer commands, e.g. `CONFigure:POWer:MSLot...`

P/Frame

The *P/Frame* hotkey selects the power versus frame measurement. In this application, the average burst power in a particular timeslot is measured over a range of consecutive TDMA frames and displayed in tabular form.

Remote control:
The *P/Frame* application is selected by the keyword `:FRAMe` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:FRAMe...`

P/Slot Graph

The *P/Slot Graph* hotkey selects the power versus slot measurement with graphical display. In this application, the average burst power in all eight timeslots of a TDMA frame is measured and displayed in a bar graph.

Remote control:
The *P/Slot Graph* application is selected by the keyword `:SLOT` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:SLOT...`

P/Slot Table

The *P/Slot Table* hotkey selects the power versus slot measurement with tabular display. In this application, the average burst power in all eight timeslots of several consecutive TDMA frames is measured and displayed in a table.

Remote control:
The *P/Slot Table* application is selected by the keyword `:XSLot` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:XSLot...`

Some of the following test settings depend on the selected application.

c) P/t Normal GMSK

All softkeys and hotkeys in the *P/t Normal GMSK* application are shown in Fig. 4-2 on page 4.9.

P/t Norm. GMSK

The *P/t Norm. GMSK* measurement control softkey controls the *P/t Norm. GMSK* measurement; see detailed explanation in section *Measurement Control* on p. 4.10. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.27 ff.

Repetition

The hotkey *Repetition* determines the repetition mode of the measurement *(Single Shot* or *Continuous* measurement).

Remote control
`CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition`
`<Repetition>``,<StopCond>,<Stepmode>`

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *On Limit Failure)*.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition
                <Repetition>,<StopCond>,<Stepmode>
```

Display Mode

The hotkey *Display Mode* determines the display mode of the measurement curve.

Remote control
no display mode set, the four measurement curves are accessible via

```
FETCh:ARRAy:POWer[:NORMal][:GMSK][:CURRent]?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:MINimum?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:MAXimum?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:AVERage? etc.
```

Statistic Count

The *Statistic Count* hotkey defines the number of bursts per statistic cycle.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol
   <Mode>,1 ... 1000 | NONE
```

Trig. Slot Offset

The *Trig. Slot Offset* hotkey defines a delay time (integer number of GSM timeslots) between the trigger time and the measured timeslot (see Fig. 4-4 on p. 4.18. In the default setting *(Trig. Slot Offset = 0)* the measured timeslot is determined by the trigger time. By varying the *Trig. Slot Offset*, an unknown GSM signal can be analyzed timeslot by timeslot at constant trigger settings.

Remote control

```
CONFigure:RFANalyzer:MCONTrol:TSOFfset 0 to 7
```

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement.

The input level and trigger settings are also provided in the *Analyzer* tab of the *Connection Control* menu. For a detailed description see section *Table-Oriented Version* on p. 4.70 ff.

RF Max. Level

The *RF Max. Level* hotkey sets the maximum expected input level in dBm.

Remote control

```
[SENSE:]LEVel:MAXimum  <Level>
```

RF Mode

The *RF Mode* hotkey determines how the input level is defined.

Manual	Manual input via *RF Max. Level* hotkey
Auto	Automatic setting according to the average burst power of the applied signal.

Remote control

```
[SENSE:]LEVel:MODE  MANual | AUTOmatic
```

RF Attenuation

The *RF Attenuation* hotkey selects a strategy for tuning the RF analyzer.

Normal	Input signal is kept unchanged
Low Noise	Enhanced mixer level. This setting ensures the full dynamic range of the CMU and is therefore recommended for *Power* and *Spectrum* measurements.
Low Distortion	Decreased mixer level. This setting ensures a high transmission reserve and is therefore recommended for *Modulation* measurements.

Remote control

```
[SENSE:]LEVel:ATTenuation  NORMal | LNOIse | LDIStortion
```

Trigger Source

The *Trigger Source* hotkey determines the trigger condition.

Free Run	Trigger by TDMA timing of the incoming burst
RF Power	Trigger on power (rising edge) of incoming burst, wideband trigger at the Front End
IF Power	Narrow-band trigger
Extern	External trigger signal fed in via connector AUX3 (pin 8)

Note: *The Free Run trigger generally slows down the measurements. It must not be used in the P/t Multislot, P/Frame, P/Slot Graph, and P/Slot Table applications.*

Remote control

```
TRIGger[:SEQuence]:SOURce
            FRUN | RFPOWer | IFPOWer | EXTern
```

Trigger Level

The *Trigger Level* hotkey determines the trigger level. This softkey is enabled for trigger source *RF Power* or *IF Power* only.

Remote control

```
TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH
```

Analyzer Settings

The *Analyzer Settings* softkey determines the template PCL, frequency and training sequence of the RF signal analyzed.

Template PCL

The *Template PCL* hotkey sets a power control level to correct the limit lines.

The template PCL merely serves to define a dynamic correction to the limit lines and the limits of the average burst power in analogy to the correction in the *Signalling* mode. It is not related to the transmit power of the mobile station under test.

Template PCLs between 0 and 31 may be selected; see tables in section *Limit Values for Average Burst Power* on page 4.103 ff.

Remote control

```
CONFigure:RFANalyzer:TPCL <PCL>
```

The following analyzer settings are described in more detail in section *RF Analyzer Settings (Connection Control – Analyzer)* on p. 4.66.

Frequency

The *Frequency* hotkey defines the frequency of the analyzed signal in MHz.

Remote control
`[SENSe:]RFANalyzer:CHANnel <Number>`

Channel

The *Channel* hotkey defines the GSM channel number of the analyzed signal.

Remote control
`[SENSe:]RFANalyzer:CHANnel <Number>`

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or GSM channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control
`[SENSe:]RFANalyzer:FREQuency:OFFSet <Offset>`

Training Sequence

The *Training Sequence* hotkey defines a training sequence for the analyzed signal.

Remote control
`[SENSe:]RFANalyzer:TSEQuence <TSC>`

Generator Settings

The *Generator Settings* softkey configures the RF signal generated.

The following generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. 4.72.

RF Level

The *RF Level* hotkey defines the generator level in the used timeslot in dBm.

Remote control
`SOURce:RFGenerator:LEVel:UTIMeslot <Level>`

Frequency

The *Frequency* hotkey defines the frequency of the RF generator signal in MHz.

Remote control
`SOURce:RFGenerator:FREQuency[:CHANnel] <Frequency>`

Channel

The *Channel* hotkey defines the GSM channel number of the generator signal.

Remote control
`SOURce:RFGenerator:FREQuency[:CHANnel] <ChannelCH>`

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or GSM channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control
`SOURce:RFGenerator:FM:DEViation <Offset>`

Training Sequence

The *Training Sequence* hotkey selects a training sequence for the generator signal.

Remote control
`CONFigure:RFGenerator:MODulation:TSEQuence:SELection <TSC>`

Bit Modulation

The *Bit Modulation* hotkey selects a bit sequence to be modulated onto the generator signal.

Remote control
`CONFigure:RFGenerator:MODulation:BIT:SELection <Sequence>`

Transmission

The *Transmission* hotkey determines the shape of the generator signal (burst signal or continuous wave with constant level).

Remote control
`CONFigure:RFGenerator:MODulation:TRANsmission <Mode>`

Marker Display

The *Marker/Display* softkey positions up to 3 markers and a D-line in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below.

Markers	are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu Power provides a reference marker and two further markers which permit to measure spacings (delta marker 1 and 2). The coordinates of the three markers are indicated in the format Ordinate value (level)/abscissa value (time) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (level in dBm and time in bits), the delta marker by absolute or relative values (relative level in dB or time differences from the reference marker).
D-line	The D-line (display line) is a horizontal line that can be positioned to mark and read out an arbitrary level in the test diagram.

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker can be positioned to arbitrary time values. It is switched off in the default setting *(Off)*. The marker level is given by the measurement curve at the marker position.

The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Rel 1

The *Rel. 1* hotkey switches the delta marker 1 on or off (use the *ON/OFF* key).

The delta marker 1 is represented by the symbol 1 in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker can be positioned to arbitrary time values. If its position is outside the diagram area it will be invisible and its coordinates will be "<abscissa_value> / - - -". The marker is switched off in the default setting *(Off)*. The marker level is given by the measurement curve at the marker position.

The toggle switch *Rel 1 Config* pops up when the hotkey is pressed for the second time. It defines whether the position of delta marker 1 is measured and indicated in absolute units (dBm) or relative to the reference marker.

Remote control
No command, screen configuration only.

Rel 2

The *Rel. 2* hotkey switches the delta marker 2 on or off (use the *ON/OFF* key). Functions and remote control are analogous to delta marker 1.

D-Line

The *D-Line* hotkey switches the D-line in the test diagram on or off.

The D-line is a horizontal, colored auxiliary line in the test diagram and is used for marking a level value and for measuring level differences. The level (ordinate) is determined in the input field *D-Line* and indicated on the D-line. The permissible value range is the diagram area, the default setting is Off.

The switch *D-Line Config.* is opened by pressing *D-Line* twice and determines whether the D-line level is expressed in absolute units (in dBm, setting absolute) or relative to the Max. Level (in dB, setting relative).

Remote control
No command, screen configuration only.

Display Marker

The *Display/Marker* softkey zooms or shifts the graphical display. It is selected by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

Display Area

The *Display Area* hotkey selects the displayed screen area.

It is possible to select either the complete burst (see Fig. 4-16), or zoom in to a particular area:

Full Range	Display of complete burst in the time range –10 bit to 157 bit and levels between –80 dBc and 10 dBc
Useful Part	Full time range, measurement curve magnified around the reference level
Left Upper Corner	Measurement curve magnified around the left upper corner
Rising Edge	Full level range, time axis from –10 bit to 10 bit
Right Upper Corner	Measurement curve magnified around the right upper corner
Falling Edge	Full level range, time axis from 139 bit to 157 bit

The screen setting and the measurement do not affect each other.

Remote control
No command, screen configuration only.

Timing Bit Offset

The *Timing Bit Offset* hotkey shifts the burst by the entered number of bits.

The burst is shifted relative to the time axis and the tolerance template for the burst analysis, see section *Limit lines (Power Configuration – Limit Lines)* on page 4.31. Therefore, the value of *Timing Bit Offset* affects the result of the tolerance check.

Remote control
`CONFigure:POWer[:NORMal][:GMSK]:TIME:BOFFset <Offset>`

Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement groups. The main measurement menu within each group is directly opened by pressing the associated hotkey.

P/t Normal 8PSK

The *P/t Normal 8PSK* test settings differ from the *P/t Normal GMSK* settings (see p. 4.11 ff.) in two softkeys.

P/t Norm. 8PSK

The *P/t Norm. 8PSK* measurement control softkey controls the *P/t Norm. 8PSK* measurement; see detailed explanation in section *Measurement Control* on p. 4.10. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.27 ff. The *Repetition, Stop Condition, Display Mode,* and *Statistic Count* softkeys behave as described in section *P/t Normal GMSK* on page 4.11 ff. In the *P/t Norm. 8PSK* application, there is one additional hotkey:

Ref Power Mode

The *Ref. Power Mode* hotkey defines whether the reference power (0-dB line) in the measurement diagram is derived from the average power of the current measurement curve *(Current),* the average power of the average curve *(Average),* or the average power of the current curve with an additional correction for the deviation due to the data modulated onto the RF signal *(Data Compens.).* See section *Measurement Control (Power Configuration – Control)* on page 4.27.

Remote control

```
CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode
   CURRent | AVERage | DCOMpens
```

Besides, the timing offset is expressed in symbol periods; the *Timing Bit Offset* hotkey assigned to the *Display/Marker* softkey is replaced by *Timing Symbol Offset.* 8PSK symbol periods and GMSK bit periods are of equal length, see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31.

e) P/t Multislot

The *P/t Multislot* test settings differ from the *P/t Normal GMSK* settings (see p. 4.11 ff.) in several respects. Most of the differences are related to the configuration of the measurement and display range.

Note: *No Free Run trigger must be used in the P/t Multislot, P/Frame, P/Slot Graph, and P/Slot Table applications.*

Multislot

The *Multislot* measurement control softkey controls the *P/t Multislot* measurement; see detailed explanation in section *Measurement Control* on p. 4.10. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. Most of these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.27 ff. The *Repetition, Stop Condition, Display Mode,* and *Statistic Count* softkeys behave as described in section *P/t Normal GMSK* on page 4.11 ff. In the *P/t Multislot* application, there are two additional hotkeys:

Slot Count

The hotkey *Slot Count* defines an integer number of timeslots to be measured. The actual measured time range is larger than the integer number of slots because it comprises an additional display margin; for details see remote control command description. The relation between the measured time range and the trigger time is given by the *Trig. Slot Offset;* see Fig. 4-4 on p. 4.18.

The display range is adapted to the *Slot Count* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys. Changing the *Slot Count* overrides the *Time Scale* settings and restores the default display range.

Remote control
`CONFigure:POWer:MSLot:SCOunt`

Trig. Slot Offset

The hotkey *Trig. Slot Offset* defines a delay time (integer number of GSM timeslots) between the trigger time and the timeslot that is measured in all *Multislot* configurations. In the graphical display, this measured timeslot is marked by *Trg. Slot Offs. 0*.

- If *Slot Count* is equal to 1, then the measurement extends over the measured timeslot plus an appropriate display margin.
- If *Slot Count* is equal to 2, then the timeslot preceding the measured timeslot *(Trg. Slot Offs. –1)* and the measured slot *(Trg. Slot Offs. 0)* are measured.
- If *Slot Count* is equal to 3 (4), then *Trg. Slot Offs – 1, Trg. Slot Offs. 0* and the next timeslot (the two next timeslots, *Trg. Slot Offs. + 1* and *Trg. Slot Offs. + 2)* are measured.

The beginning of the measured timeslot defines the origin (symbol no. 0) of the time axis. The measured timeslot is also the reference for the *Timing* measurement; it must be active to obtain valid measurement results.

The relation between the *Trig. Slot Offset*, the *Slot Count* and the measured time range for a signal with three active timeslots is shown in Fig. 4-4 below.

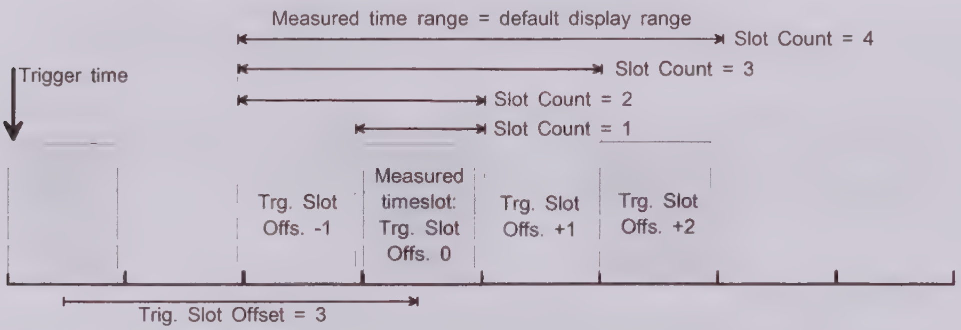


Fig. 4-4 Trigger slot offset and slot count (for Trig. Slot Offset = 3)

The display range is adapted to the *Slot Count* and *Trig. Slot Offset* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys.

Remote control
`CONFigure:RFANalyzer:MCONtrol:TSOFfset 0 to 7`

Display Marker

The *Display/Marker* softkey, which is activated by pressing the selected *Marker/Display* softkey again, configures the graphical display.

Info Box

The hotkey *Info Box* switches the info boxes for all displayed timeslots on or off. For a description of the info boxes see section *P/t Multislot* on p. 4.22 ff.

Remote control
No command, display configuration only

Timing Offset

The *Timing Offset* hotkey shifts the burst by the entered number of symbol periods, e.g. to compensate for a known, constant timing error of the MS. See section *Measurement Control (Power Configuration – Control)* on p. 4.27 ff.

Remote control
`CONFigure:POWer:MSLot:TOFFset`

Modulation View

The hotkey *Modulation View* defines the expected modulation scheme in all four timeslots that can be measured and adjusts the power/time template. To obtain a valid measurement result, the actual modulation in all measured slots (see Fig. 4-4 on p. 4.18) must be compatible with the *Modulation View* settings. See section *Measurement Control (Power Configuration – Control)* on p. 4.27 ff.

Remote control
`CONFigure:POWer:MSLot:MVIew`

Level Scale

The *Level Scale* hotkey defines a maximum RF level in dBm *(Max)* and a level range in dB *(Span)* that will be displayed in the graphical diagram and thus determines the scale of the y axis.

Remote control
No command, display configuration only

Time Scale

The *Time Scale* hotkey defines the start time *(Start)* and the total time interval *(Span)* that will be displayed in the graphical diagram and thus determines the scale of the x axis.

Both values are expressed in symbol periods. 1 symbol corresponds to approx. 3.69 µs so that 1 timeslot comprises 156 ¼ symbols. *Start* is expressed relative to symbol 0 of the measured timeslot (see Fig. 4-4 on p. 4.18). *Time Scale* only configures the diagram; it does not affect the number of timeslots actually measured but is modified as this number is changed (see *Slot Count* hotkey on p. 4.17).

Remote control
No command, display configuration only

Default Scale

The *Default Scale* hotkey sets a default *Level Scale* and a default *Time Scale*, the latter corresponding to the number of timeslots measured (see *Slot Count* hotkey on p. 4.17) plus an appropriate display margin.

Remote control
No command, display configuration only

f) P/Frame, P/Slot Graph, P/Slot Table

The *P/Frame, P/Slot Graph, and P/Slot Table* test settings differ from the *P/t Normal GMSK* settings (see p. 4.11 ff.) in several respects:

- The measurement statistics is simplified; only the repetition mode can be set.
- Everything related to the measurement curve *(Display Mode, Markers, Display settings)* is omitted.
- In the *P/Slot Table* application, the number of slot to be measured *(Slot Count)* can be set.

The remaining settings are identical with those of the *P/t Normal GMSK* application; see page 4.11 ff.

Note: *No Free Run trigger must be used in the P/t Multislot, P/Frame, P/Slot Graph, and P/Slot Table applications.*

Measurement Results

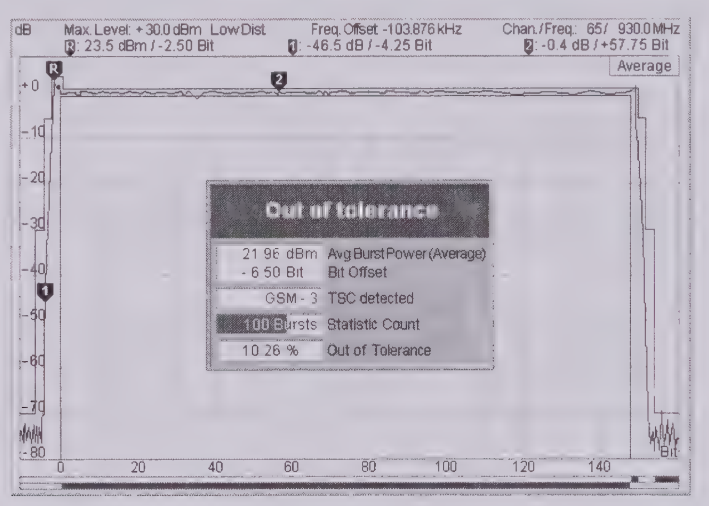
The measurement results depend on the application selected.

a) P/t Normal GMSK

The values shown in the measurement menu *Power*, application *P/t Normal GMSK,* can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

These values are indicated in two parameter lines, the test diagram and an info box:



Parameter line 1, 2

Test diagram

Info box

dB Max. Level: +30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 65/ 930.0 MHz

R: 23.5 dBm / -2.50 Bit 1: -46.5 dB / -4.25 Bit 2: -0.4 dB / +57.75 Bit

Average

Out of tolerance

21.96 dBm	Avg Burst Power (Average)
- 6.50 Bit	Bit Offset
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-8 Display of results (Power – P/t Norm. GMSK)

Settings/ scalar measurement results Settings and scalar measurement results are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

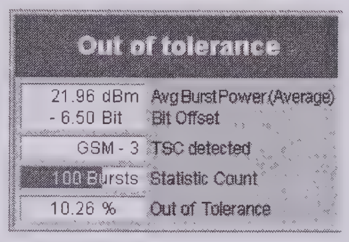
1st parameter line The first parameter line contains the following settings:

Max. Level	Maximum expected input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.70 ff.)
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)* as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.70 ff.)
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

2nd parameter line The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Info box



Out of tolerance

21.96 dBm	AvgBurstPower(Average)
- 6.50 Bit	Bit Offset
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

The info box contains the following settings:

Bit Offset	Shifting of the burst with respect to the time axis and the tolerance template. In *Signalling* mode, the measured timing advance error is displayed instead.
Statistic Count	Number of bursts per statistics cycle.

In addition, the following scalar results are indicated:

Avg Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
TSC detected	Training sequence of the measured RF burst *(GSM – 0 to 7 | Dummy |* ---.
Out of Tolerance	Relative number of bursts that are out of the tolerances defined by the limit lines.
Burst Matching	Error message if the displayed curve is out of tolerance.

Remote control
Settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer[:NORMal][:GMSK]?
CALCulate[:SCALar]:POWer[:NORMal][:GMSK]
   :LIMit:MATChing?
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?
```

Measurement curves (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on various test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be adjusted via the *Display Area* hotkey (see section *P/t Normal GMSK* on p. 4.20).

Remote control

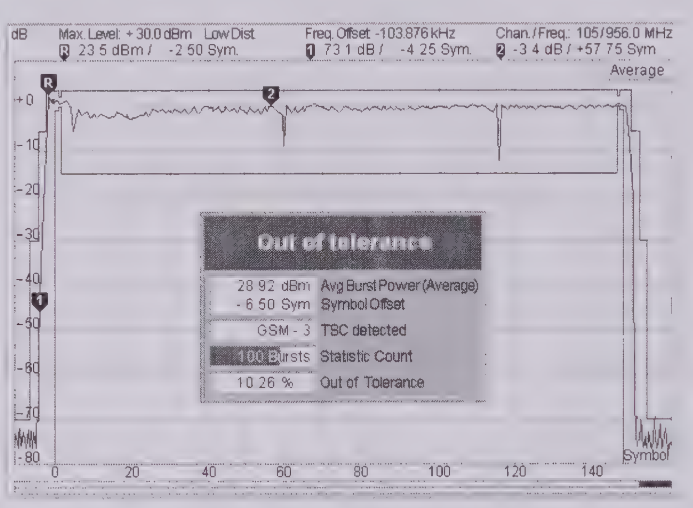
```
READ:ARRay:POWer[:NORMal][:GMSK]...?
CALCulate[:SCALar]:POWer[:NORMal][:GMSK]
   :LIMit:MATChing?
FETCh:ARRay:POWer[:NORMal][:GMSK]...?
SAMPle:ARRay:POWer[:NORMal][:GMSK]...?
```

b) P/t Normal 8PSK

As shown in Fig. 4-9 below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results. The following differences occur:

- With 8PSK modulation, the time axis is scaled in symbol periods. 8PSK symbol periods and GMSK bit periods are of equal length.
- The default limit lines differ from the GMSK limit lines.

See explanation of GSM burst structure and power/time templates in section *Limit lines (Power Configuration – Limit Lines)* on page 4.31 ff.



Parameter line 1, 2

Test diagram

Info box

dB Max. Level: + 30.0 dBm Low Dist Freq. Offset -103.876 kHz Chan./Freq.: 105/956.0 MHz

R 23 5 dBm / -2 50 Sym. 1 73 1 dB / -4 25 Sym. 2 -3 4 dB / +57 75 Sym

Out of tolerance

28 92 dBm Avg Burst Power (Average)

- 6 50 Sym Symbol Offset

GSM - 3 TSC detected

100 Bursts Statistic Count

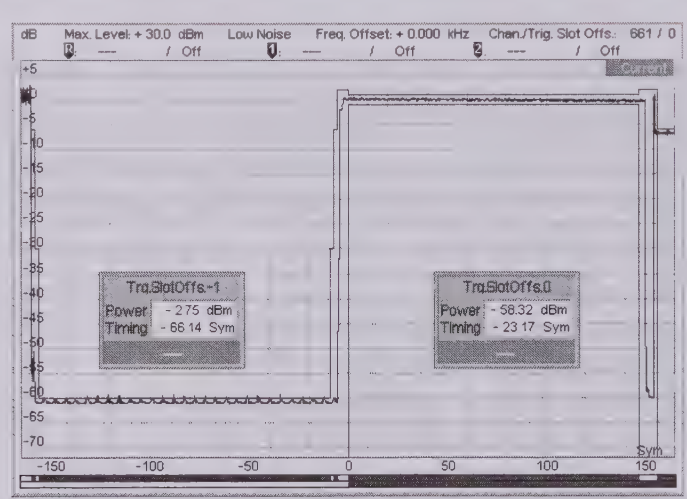
10 26 % Out of Tolerance

Fig. 4-9 Display of results (Power – P/t Norm. 8PSK)

c) P/t Multislot

As shown in Fig. 4-10 below, the *P/t Multislot* measurement results are similar to the *P/t Normal GMSK* results. The following differences occur:

- The first parameter line shows the selected *Trig. Slot Offset*, see p. 4.18.
- The info boxes, the diagram and the limit lines differ from the single-slot configuration, see below.



Parameter line 1, 2

Test diagram

Info boxes

Limit Check

dB Max. Level: + 30.0 dBm Low Noise Freq. Offset: + 0.000 kHz Chan./Trig. Slot Offs.: 661 / 0

R: --- / Off 1: --- / Off 2: --- / Off

Trg.SlotOffs.-1

Power - 275 dBm

Timing - 66 14 Sym

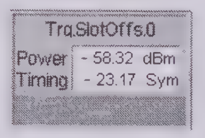
Trg.SlotOffs.0

Power - 58.32 dBm

Timing - 23 17 Sym

Fig. 4-10 Display of results (Power – P/t Multislot)

Info boxes



Trg.SlotOffs.0
Power - 58.32 dBm
Timing - 23.17 Sym

The info boxes show the following properties of the individual timeslots:

Power	Average burst power in dBm. The *Power* result depends on the display mode as indicated in the upper right corner of the diagram.
Timing	Timing advance error of the burst in symbol periods

Below the two measurement results, an error message is displayed if the burst is out of tolerance. An info box is provided for each timeslot displayed (1 to 4; see *Slot Count* hotkey on p. 4.17). The boxes can be suppressed altogether by means of the *Display/Marker – Info Box* hotkey.

Remote control
Settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:MSLot?
CALCulate[:SCALar]:POWer:MSLot
  :LIMit:MATChing?
FETCh[:SCALar]:POWer:MSLot?
SAMPle[:SCALar]:POWer:MSLot?
```

Measurement curves (arrays)

The measurement result is displayed together with the limit lines, markers and the D-line (if defined) as a continuous measurement curve in the test diagram. The curve is derived from equidistant measurement points with a ¼ symbol spacing the number of which depends on the number of timeslots measured (see *Slot Count* hotkey on p. 4.17, for details see remote control command description).

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in symbol periods). The displayed result depends on various test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be adjusted via the hotkeys associated to the *Display/Marker* softkey (see section *P/t Multislot* on p. 4.17 f.).

Remote control
`READ:ARRay:POWer:MSLot...?` etc.

Limit Check

The result of the limit check is visualized in two colored bars below the diagram. In each area of the burst, the upper (lower) bar turns red if the result exceeds (falls below) the power/time template defined in the *Limit Lines* tab of the *Power Configuration* menu.

Remote control

```
CALCulate[:SCALar]:POWer:MSLot:LIMit:MATChing?
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing...?
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing...?
```

d) P/Frame

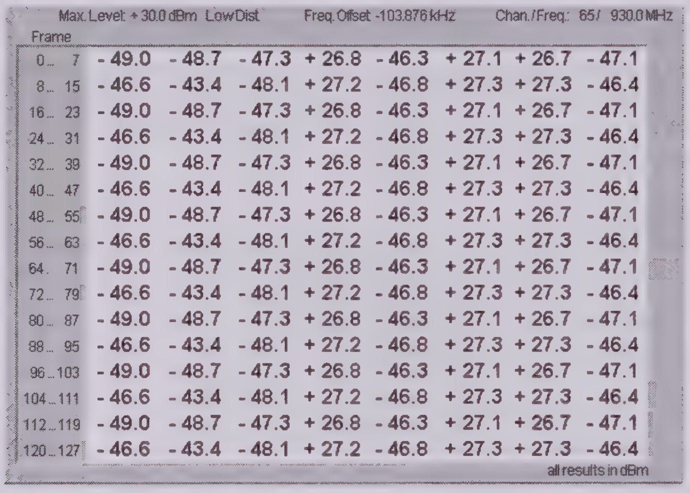
The results displayed in the measurement menu *Power*, application *P/Frame,* can be divided into two groups:

- Settings
- Measurement results, i.e. the average burst power in 128 consecutive TDMA frames.

The measurement results are indicated in a parameter line, the test diagram and a table:

Parameter line

Frame table



Max. Level: + 30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 65/ 930.0 MHz

Frame								
0... 7	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
8... 15	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
16... 23	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
24... 31	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
32... 39	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
40... 47	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
48... 55	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
56... 63	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
64... 71	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
72... 79	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
80... 87	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
88... 95	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
96...103	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
104...111	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
112...119	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
120...127	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4

all results in dBm

Fig. 4-11 Display of results (Power – P/Frame)

Settings

The essential settings are indicated in a parameter line above the test diagram. The line is identical to the first parameter line of the test diagram in the *P/t Normal GMSK* application.

Results

The *P/Frame* application measures the average burst power in a particular timeslot and over 128 consecutive TDMA frames. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The time slot number within the TDMA frame depends on the trigger time for the first measurement.

A particular timeslot can be selected with an appropriate trigger condition. E.g., if the power in the timeslot to be measured is clearly higher than the power in the remaining seven timeslots, a power trigger (trigger settings *RF Power* or *IF Power)* can be used. Otherwise, use an appropriate external trigger signal.

The 128 values are shown in a tabular overview. No limit check is performed.

Note: *In* Continuous *measurements* (Repetition = Continuous)*, the results in the table are updated row by row. After the end of each measurement cycle the update re-starts in the first table row. To clearly distinguish the current from the previous cycle, 4 strokes are inserted after the most recent measurement result.*

Remote control

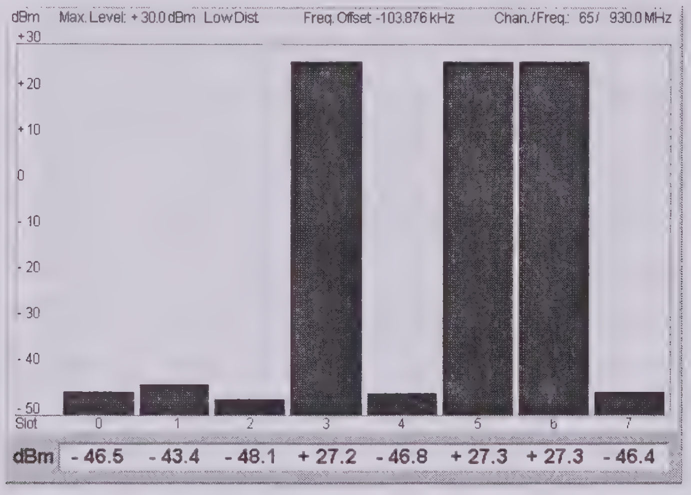
```
READ:ARRay:POWer:FRAMe[:CURRent]?
READ[:SCALar]:POWer:FRAMe:FPOWer<nr>[:CURRent]?
FETCh:ARRay:POWer:FRAMe[:CURRent]?
SAMPle:ARRay:POWer:FRAMe[:CURRent]?
```

e) P/Slot Graph

The results displayed in the measurement menu *Power*, application *P/Slot Graph*, can be divided into two groups:

- Settings
- Measurement results, i.e. the average burst power in all eight slots of a TDMA frame

The measurement results are indicated in a parameter line, the test diagram and a table:



Parameter line

Test diagram

Slot table

dBm Max. Level: +30.0 dBm LowDist Freq. Offset -103.876 kHz Chan./Freq.: 65/ 930.0 MHz

Slot	0	1	2	3	4	5	6	7
dBm	- 46.5	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4

Fig. 4-12 Display of results (Power – P/Slot menu)

Settings The essential settings are indicated in a parameter line above the test diagram. The line is identical to the first parameter line of the test diagram in the *P/t Normal GMSK* application.

Results The *P/Slot* application measures the average burst power in eight consecutive time slots. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The time slots are numbered 0 to 7; however, this does not mean that they all belong to the same TDMA frame (slot 0 to 7).

A particular timeslot can be selected as timeslot 0 with an appropriate trigger condition. E.g., if the power in one timeslot is clearly higher than the power in the remaining seven timeslots, a power trigger (trigger settings *RF Power* or *IF Power)* can be used. Otherwise, use an appropriate external trigger signal.

The eight values are shown in a bar graph and in a tabular overview below. No limit check is performed.

Remote control

```
READ:ARRay:POWer:SLOT[:CURRent]?
FETCh:ARRay:POWer:SLOT[:CURRent]?
SAMPle:ARRay:POWer:SLOT[:CURRent]?
```

f) P/Slot Table

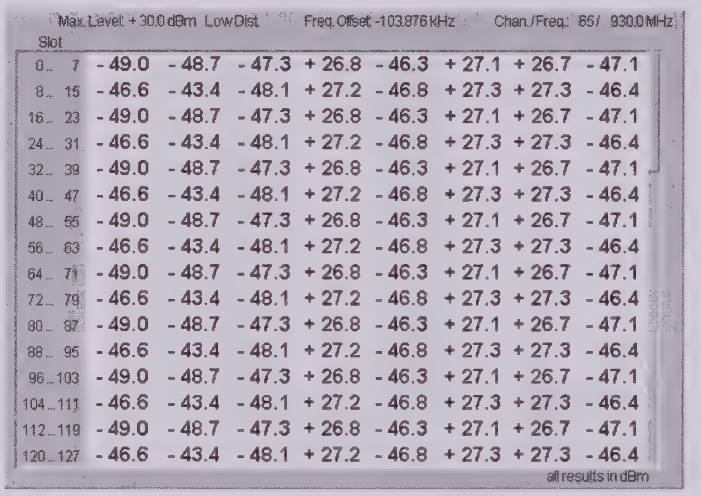
The results displayed in the measurement menu *Power*, application *P/Slot Table,* can be divided into two groups:

- Settings
- Measurement results, i.e. the average burst power in n*128 consecutive TDMA timeslots (n = 1 to 4).

The measurement results are indicated in a parameter line, the test diagram and a table:

Parameter line

Slot table



Max.Level: +30.0 dBm LowDist Freq.Offset -103.876 kHz Chan./Freq.: 65/ 930.0 MHz

Slot								
0... 7	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
8... 15	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
16... 23	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
24... 31	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
32... 39	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
40... 47	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
48... 55	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
56... 63	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
64... 71	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
72... 79	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
80... 87	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
88... 95	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
96...103	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
104...111	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4
112...119	- 49.0	- 48.7	- 47.3	+ 26.8	- 46.3	+ 27.1	+ 26.7	- 47.1
120...127	- 46.6	- 43.4	- 48.1	+ 27.2	- 46.8	+ 27.3	+ 27.3	- 46.4

all results in dBm

Fig. 4-13 Display of results (Power – P/Frame)

Settings The essential settings are indicated in a parameter line above the test diagram. The line is identical to the first parameter line of the test diagram in the *P/t Normal GMSK* application.

Results The *P/Slot Table* application measures the average burst power over up to 512 consecutive TDMA timeslots, corresponding to 64 TDMA frames. The average is taken over a section of the useful part of the burst; it is not correlated to the training sequence. The number of slots *(Slot Count)* to be measured is set in the *Control* tab of the *Power Configuration* menu; see p. 4.27 ff.

The table displays up to 128 results at the same time. To be consistent with the numbering of the timeslots within a TDMA frame, the *Slot Count* starts from 0 (see also remarks on TDMA timing in section *P/Frame, P/Slot Graph, P/Slot Table* on p. 4.99). For *Slot Count* values >127 (128 measured slots), the table can be scrolled using the cursor keys. No limit check is performed.

Note: *In Continuous measurements (Repetition = Continuous), the results in the table are updated row by row. After the end of each measurement cycle the update re-starts in the first table row. To clearly distinguish the current from the previous cycle, 4 strokes are inserted after the most recent measurement result.*

Remote control

```
READ:ARRay:POWer:XSLOT[:CURRent]?
FETCh:ARRay:POWer:XSLOT[:CURRent]?
SAMPle:ARRay:POWer:XSLOT[:CURRent]?
```

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains three tabs to determine the parameters controlling the power measurement including the error tolerances.

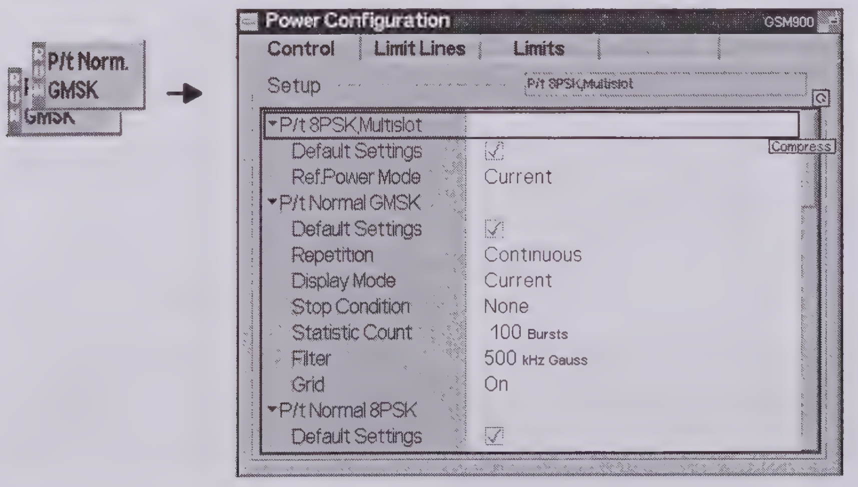
The popup menu *Power Configuration* is activated by pressing the measurement control softkey at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The *Control* tab controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement (for burst power vs. time measurements only)
- The type of measurement curve displayed *(Display Mode,* for burst power vs. time measurements only)
- The measurement *Filter* for *P/t Normal GMSK* and *P/t Normal 8PSK* measurements
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count,* for burst power vs. time measurements only)
- The averaging prescription to obtain the reference power *(Ref. Power Mode*, for *8PSK* measurements only)
- The *Timing Offset*, the expected modulation *(Modulation View)*, the number of slots measured *(Slot Count)* and the *Info Box* in the *P/t Multislot* application
- The number of timeslots measured *(Slot Count)* in the *P/Slot Table* application

Besides, it configures the graphical diagrams by adding or removing the *Grid*.



Setup P/t 8PSK,Multislot

▾P/t 8PSK,Multislot	
Default Settings	☑
Ref.Power Mode	Current
▾P/t Normal GMSK	
Default Settings	☑
Repetition	Continuous
Display Mode	Current
Stop Condition	None
Statistic Count	100 Bursts
Filter	500 kHz Gauss
Grid	On
▾P/t Normal 8PSK	
Default Settings	☑

Fig. 4-14 Power Configuration – Control

The settings can be defined independently for the different applications of the *Power* measurement group. The following settings are available in several applications:

Default Settings	The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual modulation schemes are provided.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:DEFault  ON | OFF
etc.
```

Repetition

The *Repetition* field determines the repetition mode:

Single Shot	Single-shot measurement: the measurement is stopped after a statistics cycle (or after a stop condition is met, see below). A stopped measurement is indicated by the status display *HLT* in the *Power* softkey. Unless otherwise stated, a statistics cycle corresponds to the number of bursts/evaluation periods set under *Statistic Count*.
Continuous	Continuous measurement: The CMU continues the measurement until it is terminated explicitly (or until the stop condition for the measurement is met, see below). The measurement results are valid after one statistics cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the softkey *Power*.

Single shot should be selected if only a single measurement result is required under fixed conditions. The continuous measurement is suitable for monitoring the evolution of a measured quantity in time, for example for adjustments.

Note: *In remote mode, the counting measurement (counting mode) is available as a further measurement mode with a defined number of measurement cycles to be performed, see chapter 6 of this manual.*

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition
       CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,
                                          <Stepmode> etc.
```

Stop Condition

The *Stop Condition* field defines a stop condition for the measurement:

NONE	Continue measurement irrespective of the results of the limit check
On Limit Failure	Stop measurement as soon as the limit check fails (one of the tolerances is exceeded)

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition
        <Repetition>,SONerror | NONE, <Stepmode> etc.
```

Display Mode

The *Display Mode* field defines which of the four measured and calculated measurement curves is displayed. The measurement curves differ in the way the burst power *p(t)* at a fixed point in time *t* is calculated if the measurement extends over several bursts:

Current	Measured value for current burst
Minimum	Minimum over a number of bursts
Maximum	Maximum over a number of bursts
Average	Average value over a number of bursts

The number of bursts for calculation of the statistical values *Minimum, Maximum* and *Average* – and thus the result – depends on the repetition mode set (see section *Measurement Control (Power Configuration – Control)* on page 4.27). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle.

Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the prescription in Chapter 3, section *General Settings*.

Remote control
no display mode set explicitly, the four measurement curves are accessible via

```
FETCh:ARRAy:POWer[:NORMal][:GMSK][:CURRent]?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:MINimum?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:MAXimum?
FETCh:ARRAy:POWer[:NORMal][:GMSK]:AVERage? etc.
```

Statistic Count

The input field *Statistic Count* defines the length of the statistics cycles in bursts.

The settings *1* and *OFF* (press *ON/OFF* key) are equivalent. A statistics cycle determines the duration of single-shot measurements (see section *Measurement Control (Power Configuration – Control)* on page 4.27).

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol
  <MODE>,1 ... 1000 | NONE
```

Filter

The input fields *Filter* determine which type of measurement filter is used for the P/t measurements:

500 kHz Gauss	Gauss filter with a 3-dB bandwidth of 500 kHz, recommended for GMSK modulation
600 kHz Band	Bandpass filter with a bandwidth of 600 kHz and steep edges, recommended for 8PSK modulation

Both filters are in accordance with the conformance specification GSM 11.10.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:Filter G500 | B600
CONFigure:POWer[:NORMal]:EPSK:Filter G500 | B600
```

Grid

The *Grid* button switches the grid on or off in the graphical test diagram. By default, the grid is switched on.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:GRID  ON | OFF
```

The following settings are application-specific:

P/t Normal 8PSK, P/t 8PSK, Multislot – Ref. Power Mode

The *Ref. Power Mode* determines how the reference power, i.e. the 0-dB line in the measurement diagram, is calculated. The setting is valid for **both** single-slot and multislot measurements on 8PSK modulated signals.

Current	The reference power depends on the *Display Mode* set. It is equal to the average power of the *Current* measurement curve (display mode *Current)* or to the average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.
Average	The reference power is equal to the average power of the average measurement curve.
Data Compens.	The reference power depends on the *Display Mode* set. It is equal to the data-compensated average power of the *Current* measurement curve (display mode *Current)* or to the data-compensated average power of the *Average* measurement curve (display mode *Average, Maximum, or Minimum)*.

Average power denotes the RF carrier power averaged over the useful part of the measured burst (application *P/t Normal 8PSK)* or of the measured timeslot (application *P/t Multislot* with 8PSK modulation, see *Slot Count* softkey on p. 4.17).

Owing to the characteristics of 8PSK modulation, the amplitude of the RF signal varies with the transmitted data. As a consequence, only the long term average of the power when taken over the useful part of the burst for random data represents a correct measure for the output power of the mobile phone. This long time average (rather than the average power of the current burst) is also the correct reference power (0-dB line) for the *P/t Norm. 8PSK* measurement.

The *Average* setting ensures that a correct reference power is used, however, averaging results in a longer measurement time. In the *Data Compensated* mode, a known data sequence is used to correct the measured average power of the current burst and estimate the correct reference power. Delays due to averaging are avoided.

Remote control
```
CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode
  CURRent | AVERage | DCOMpens
```

P/t Multislot – Timing Offset

The *Timing Offset* shifts the burst by the entered number of symbol periods, e.g. to compensate for a known, constant timing error of the MS. The burst is shifted relative to the time axis and the tolerance template for the multislot burst analysis. Therefore, the value of *Timing Offset* affects the result of the tolerance check.

Remote control
```
CONFigure:POWer:MSLot:TOFFset
```

P/t Multislot – Modulation View

The *Modulation View* section defines the expected modulation scheme in all four timeslots that can be measured and adjusts the power/time template. To obtain a valid measurement result, the actual modulation in all measured slots must be compatible with the *Modulation View* settings. Otherwise, the CMU displays a warning: *"Signal does not match configuration!"*

The following settings are provided for all slots:

GPSK	GMSK modulation expected; the GMSK power/time template is used
8PSK	8PSK modulation expected; the 8PSK power/time template is used
ANY	Arbitrary modulation scheme; the CMU determines the modulation of the measured burst and uses the appropriate template. Valid results are obtained with both GMSK and 8PSK modulation.
OFF	No signal expected: timeslot must be inactive to obtain a valid result

The *Modulation View* settings are ignored for all slots that are not measured.

Remote control
```
CONFigure:POWer:MSLot:MVIew
```

P/t Multislot – Slot Count

The *Slot Count* defines an integer number of timeslots to be measured in the P/t Multislot application. The actual time range measured is larger than the integer number of slots because it comprises an additional display margin; for details see remote control command description.

Remote control
```
CONFigure:POWer:MSLot:SCOunt
```

P/t Multislot – Info Box

The *Info Box* parameter switches the info boxes for all displayed timeslots on or off.

Remote control
No command, display configuration only

P/Slot Table – Slot Count

The input field *Slot Count* defines the total number of slots measured in the *P/Slot Table* application. To be consistent with the numbering of the timeslots within a TDMA frame, the *Slot Count* starts from 0. Values up to 511 (corresponding to 512 slots measured in total) are available.

Remote control
`CONFigure:POWer:XSLot:SCOunt`

Limit lines (Power Configuration – Limit Lines)

The *Limit Lines* tab defines the limit lines for the burst power vs. time measurements (applications *P/t Norm. GMSK*, *P/t Norm. 8PSK,* and *P/t Multislot*). The upper and lower limit lines mark a domain in the power versus time diagram that the MS transmitter output power must not exceed (tolerance template). The GSM templates consist of several adjacent time intervals (areas) with constant limits covering the whole timeslot.

Burst structure in the GSM mobile radio network:

GMSK modulation

In the GSM mobile radio network, all radio channels are divided into frames with 8 timeslots, each with a duration of 15/26 ms ≈ 577 µs. In this time mask, bursts with various types of bit patterns are transferred:

Normal burst	Used for data transmission on the traffic channel and on the control channels except RACH.
Access burst	Used by the mobile (MS) for initial random access to the nework and for handover.
Other burst types	Dummy burst, frequency correction burst, synchronization burst, are only used by the BTS.

The basic GSM modulation scheme is GMSK modulation. With this modulation scheme, the data transmission rate is 270.833 kbit/s, resulting in a bit duration of 3.69 µs/bit. The bit structure of the GSM bursts is shown in Fig. 4-38. Compared to a normal burst, the access burst has a longer guard period (68.25 bit instead of 8.25 bit) whereas the length of the useful part of the burst (useful duration) is shortened by 60 bits. The extended guard period is needed since timing advance is not known at initial random access and handover.

The tolerance template for normal (NB) and access bursts (AB) can be divided into different areas. These areas are used as a basis for the definition of the limit lines and are shown in the following diagram (Fig. 4-16).

Note that in upper areas 2 and 7, the limit lines depend on the PCL of the mobile phone. In the CMU, this can be taken into account by defining a PCL-dependent, dynamic correction to the static limit lines, which is explained in the *Limit Lines* section of the *Signalling* mode (see p. 4.102).

Note: *In* Non Signalling *mode, only normal bursts can be measured. The access bursts transmitted by the mobile phone to initiate a location update can be analyzed in Signalling mode; see section* Power Measurements *on page 4.88 ff. The reference level (0 dB line) is equal to the received transmitter carrier power, i.e. the average value of the transmitter carrier power over the useful part of the burstduration of the burst as received by the CMU. The burst is fitted into the tolerance template such that the transition between bit 13/14 of the training sequence corresponds to the center of the useful part of the burst. This timing reference can be modified via the* Time *softkey, see section* Test Settings *on page 4.9.*

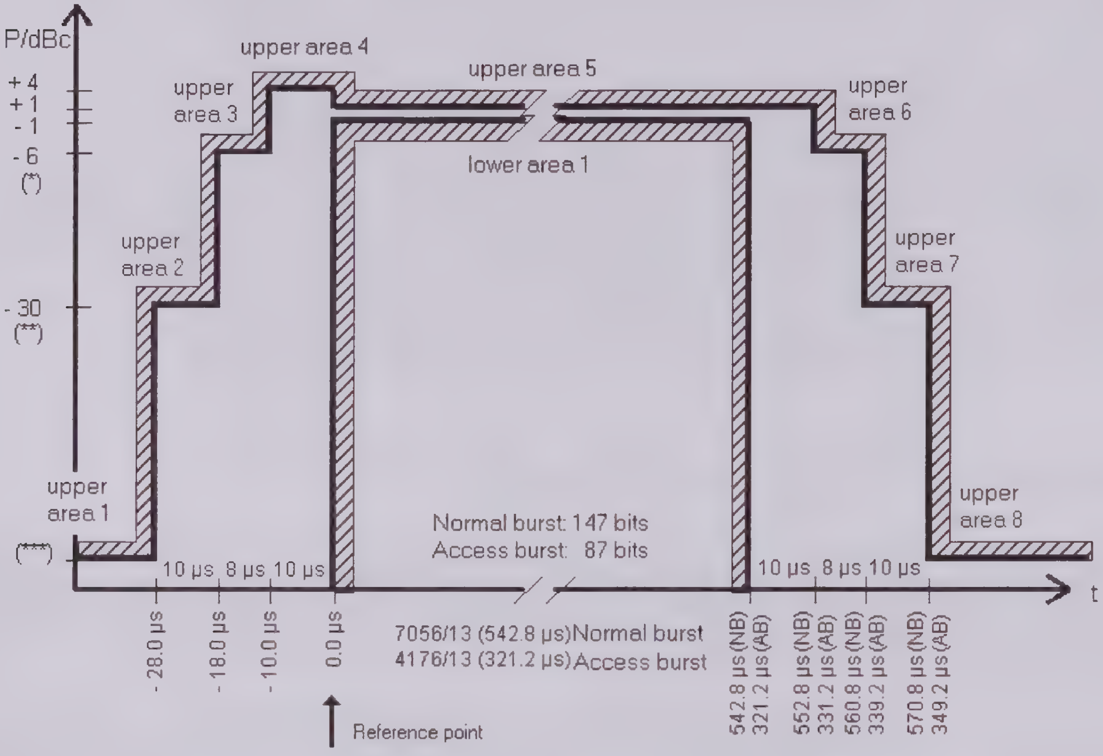


Fig. 4-16 GSM power/time template for normal and access bursts with GMSK modulation

The two edges of the tolerance templates are defined as a function of the power control level of the mobile phone. The following specifications apply to both modulation schemes (Fig. 4-16 and Fig. 4-17):

	GSM400/850/900-MS	**GSM1800/1900-MS**
(*)	–4.0 dBc for power control level (PCL) 16;	–4.0 dBc for PCL 11
	–2.0 dBc for PCL 17;	–2.0 dBc for PCL 12
	–1.0 dBc for PCL 18 and 19.	–1.0 dBc for PCL 13, 14, and 15.
(**)	–30.0 dBc or –17.0 dBm (higher value)	–30.0 dBc or –20.0 dBm (higher value)
(***)	–59.0 dBc or –36.0 dBm (higher value)	–48 dBc or -48 dBm (higher value)

The limit lines for GMSK and 8PSK modulation are set in separate table sections but in an analogous way:

8PSK modulation

8PSK modulation was introduced to GSM with release 1999 (GSM 05.05 version 7.1.0). 8PSK channels (the so-called EDGE channels) are used for data transmission; only normal bursts are transmitted. The modulating symbol rate is the same as in GMSK modulation (270.833 ksymb/s), which corresponds to a bit rate of 3 x 270.833 kbit/s. The CMU uses the same time scale for both modulation schemes; a bit duration in GMSK modulation is equal to a symbol duration in 8PSK modulation.

The power template for 8PSK burst differs from the GMSK power template; see Fig. 4-17 below. In analogy to GMSK modulation, the limit lines at the edges of the burst depend on the PCL of the mobile phone.

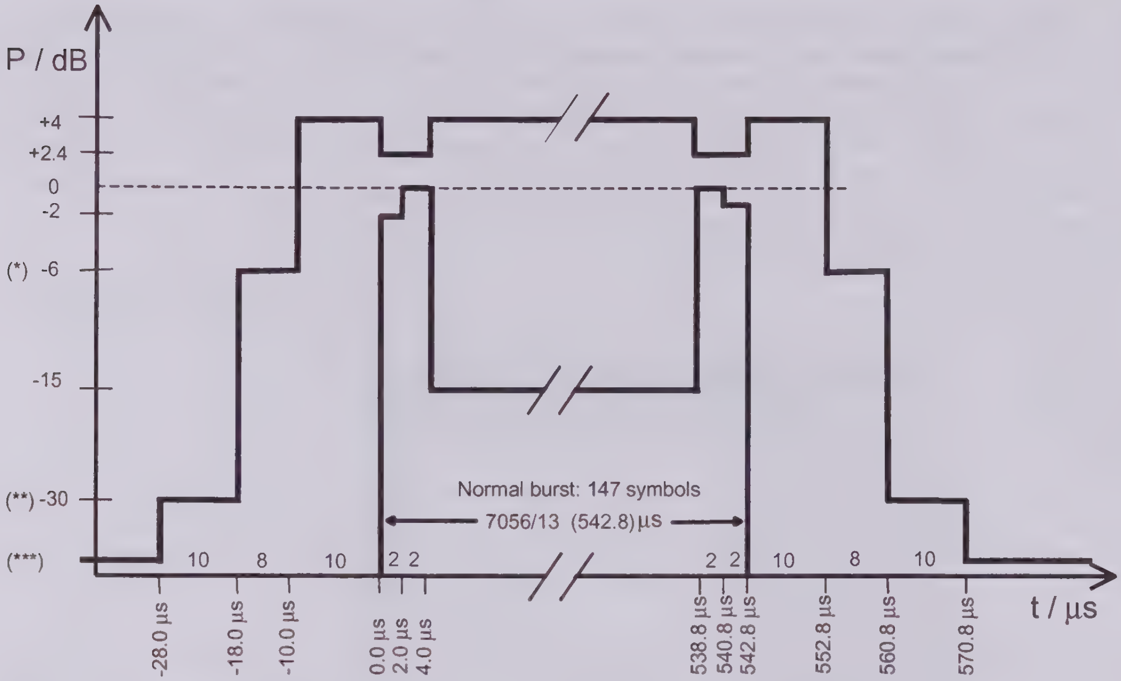


Fig. 4-17 GSM power/time template for normal bursts with 8PSK modulation (according to GSM05.05 version 8.5.0; see explanation after previous figure)

The limit lines for multislot configurations are based on the single-slot limit lines:

Multislot configurations According to GSM 11.10, the power/time template for multislot configurations coincides with the template for a single GSM burst except in the guard period between every two consecutive active timeslots, where the output power shall not exceed the level allowed for the useful part of the first timeslot or the level allowed for the useful part of the second timeslot plus a multislot guard level of 3 dB, whichever is the highest. The template for two consecutive 8PSK modulated timeslots with the same output power is shown in Fig. 4-18 below.

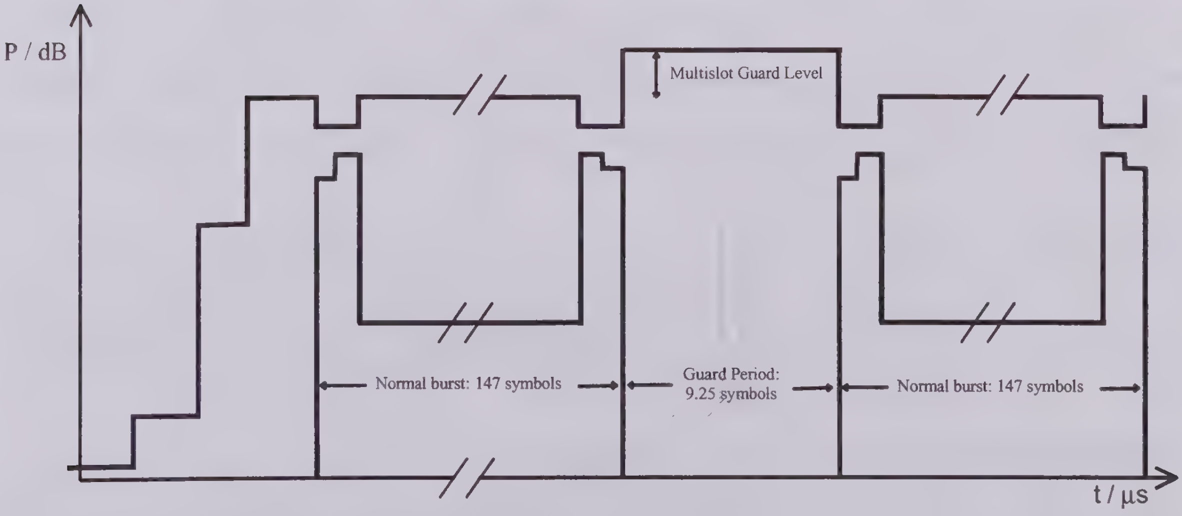
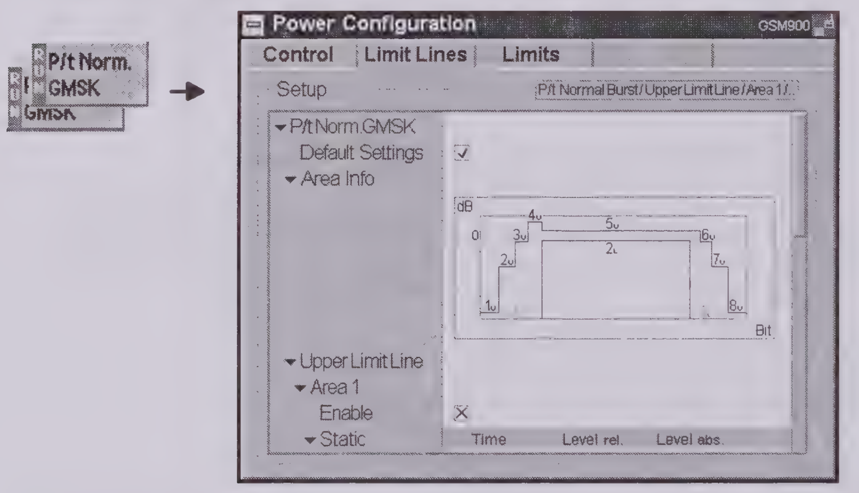

P / dB
Multislot Guard Level
Normal burst: 147 symbols
Guard Period: 9.25 symbols
Normal burst: 147 symbols
t / µs

Fig. 4-18 GSM power/time template for multislot configurations

Note: *The CMU treats the areas where the* ***lower*** *limit lines are switched on as the useful part of the burst; the remaining areas form the guard period. The tester calculates the multislot tolerance template from the single-slot limit lines and the* Multislot Guard *level (see below) and normalizes it to the average RF carrier power in the useful part of the* Meas. Timeslot. *This implies that the tolerance template is changed if the useful part of the burst is extended by enabling an additional lower limit area.*

The *Limit Lines* tab provides:

- A preview of the default limit lines showing the different areas *(Area Info)*
- Definition of the limit lines for the normal burst area by area *(Upper Limit Line, Lower Limit Line)*



Default Settings ☑

Enable ☒

Fig. 4-19 Power Configuration – Limit Lines

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual modulation schemes are provided.

Remote control
`CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:DEFault  ON | OFF`

Area Info The *Area Info* diagram represents a simplified preview of the defined tolerance template.

Remote control
–

Upper Limit Line The table *Upper Limit Line* defines the upper limit lines for normal bursts. The normal burst can be divided into up to 16 areas *(Area 1 to Area 16)*; within an area, the limit line represents a line section with arbitrary (even infinite) slope. In all areas, the static limit lines can be corrected (shifted) by adding a dynamic (i.e. template PCL-dependent) correction. The CMU's power template is thus far more flexible than the GSM template shown above.

Static limit lines The *Static* limit lines are defined as follows:

Area 1 to 16	Area number
Enable	Enabled (switch on) or disabled (and invisible) limit line. A disabled limit line implies that the limit check for the area is switched off as well.
Time	Start and (below) stop time of the area in bits

Level rel.	Start and (below) stop level of the area in units relative to the carrier. The reference level (0-dB line) is the carrier power averaged over the useful part of the burst.
Level abs.	Start and (below) stop level of the section in absolute units (dBm).

The input of relative and absolute limit values is optional; both can be switched off for valid areas (setting *Off*). If both absolute and relative limit values are specified in an area, the tolerance template and the results of the limit check refer to the **looser** criterion.

The permissible ranges for the upper and lower limit lines, i.e. of the quantities *Time, Level rel.*, and *Level abs.* vary according to the area numbers, see command description in chapter 6.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>
         [:STATic]:ENABle  ON | OFF
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>[:STATic]
         <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
         <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

Dynamic limit line correction

The *Dynamic* limit line section, serves to correct the limit lines depending on the *Template PCL*. It is defined as follows:

Range 1 to 10	Continuous range of power control levels defined by start PCL and stop PCL
PCL from	Lowest template power control level in the range
PCL to	Highest template power control level in the range
Correction	Correction value in dB to be applied to the whole range
Enable	Enabled (switch on) or disabled dynamic correction

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>:DYNamic:
ENABle ON | OFF
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer:ALL:DYNamic:
ENABle ON | OFF
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>
         :DYNamic<RangeNr>
         <fromPCL>,<toPCL>,<Correction>,<Enable> etc.
```

Lower Limit Line

The table *Lower Limit Line* defines the lower limit lines for normal bursts. All settings are analogous to the upper limit lines.

Remote control

```
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>
         [:STATic]:ENABle  ON | OFF
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>[:STATic]
         <StartTime>,<EndTime>,<StartRelLevel>,<EndRelLevel>,
         <StartAbsLevel>,<EndAbsLevel>,<Visibility>
```

P/t Multislot – Multislot Guard

The *Multislot Guard* parameter defines the level in dB by which the upper limit line in the guard period between two consecutive bursts is raised (see Fig. 4-18 on p. 4.33): The upper limit line in the guard period equals the upper limit line in the useful part of the first timeslot or the upper limit line in the useful part of the second timeslot plus *Multislot Guard*, whichever is the highest. No lower limit line is defined during the guard period.

Remote control
`CONFigure:POWer:MSLot:LIMit:LINE:GLEVel <Level>`

Limit Values for Average Burst Power (Power Configuration – Limits)

The tab *Limits* defines tolerance limits for the average burst power depending on the *Template PCL* defined via the *Analyzer Settings – Template PCL* hotkey. The limits apply to all applications of the *Power* menu providing a limit check (not to *P/Frame, P/Slot Graph* and *P/Slot Table)*.

The limits are defined in analogy to the *Signalling* mode where they depend on the actual PCL of the mobile phone; see section *Limit Values for Average Burst Power* on page 4.103 ff.

Modulation Measurements

The menu group *Modulation* comprises the functions for measurement of the modulation parameters of the RF signal transmitted by the mobile phone. The measurement results are displayed in the graphical measurement menu *Modulation,* the popup menu *Modulation Configuration* is used for configuration of the measurements.

The characteristics of the modulation measurement, the measured quantities and the measurement menus depend largely on the modulation scheme *(GMSK* or *8PSK* modulation). For the sake of clarity, the two modulation schemes are explained separately throughout the remainder of the *Modulation Measurements* section.

Measurement Menu (Modulation – GMSK)

If the GMSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.38 ff), the graphical measurement menu *Modulation* displays the results of the extended phase and frequency error analysis.

- The measurement control softkey *Ext. Phase Err. GMSK* controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the *Modulation* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Test Settings* on page 4.3.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-MS Non Signalling* using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Frequency and phase errors are determined as follows:

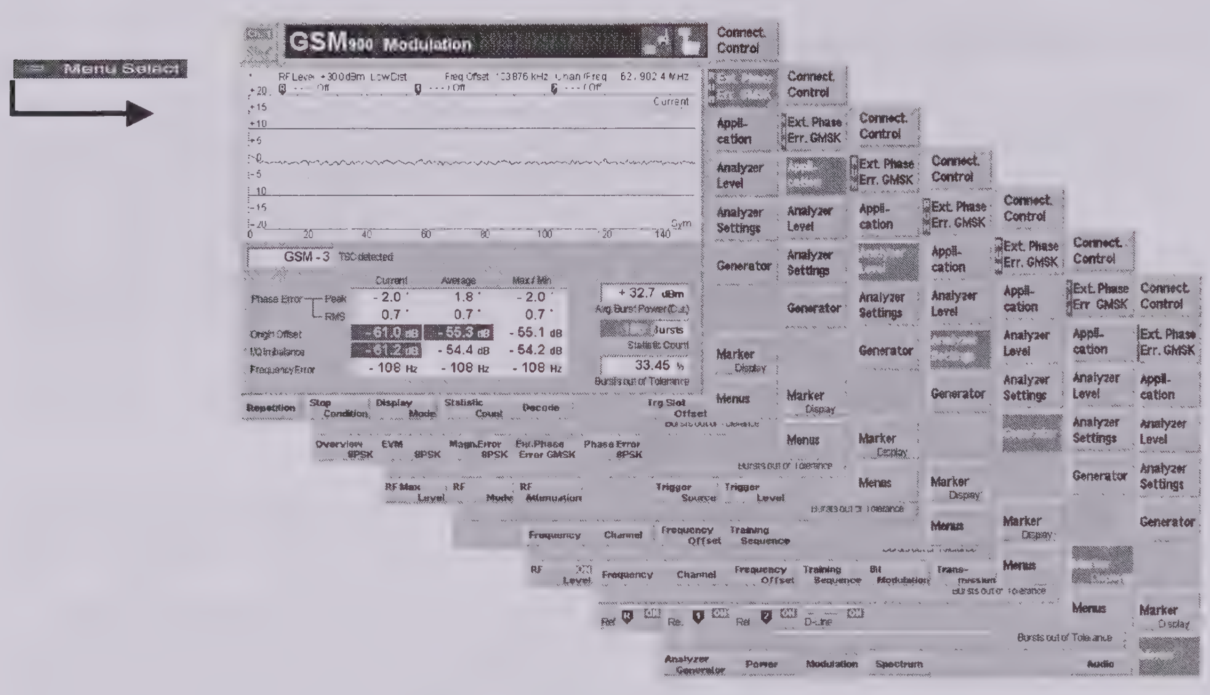
The actual phase of the signal received from the mobile station is recorded during the entire burst and stored. The transferred data is demodulated and the training sequence searched for. The middle of the training sequence is used for time synchronization (transition between bit 13/14).

The complete data content of the burst is then mathematically modulated using an ideal modulator. The resulting ideal phase is compared with the measured phase. From the difference between the two quantities (the phase difference trajectory), a regression line is calculated using the Mean Square Error method. The *phase error* is the difference between the phase difference trajectory and the regression line; it is calculated and plotted over the whole useful part of the burst (147 bits). The average *frequency error* in the burst is equal to the derivative of the regression line with respect to time.

The **Origin Offset** and the **I/Q Imbalance** characterize the accuracy of the I/Q modulation. They are defined and measured in analogy to the 8PSK modulation scheme; see (see Fig. 4-23 on page 4.43 and Equation 4-1).

For the **tolerance check** the phase error trajectory is fitted into the tolerance template and checked for tolerance violations. According to GSM specifications, a maximum peak phase error of $\pm 20^0$, a maximum RMS phase error of $\pm 5^0$, and a frequency error of 0.05 ppm referred to the carrier frequency is allowed.

The CMU evaluates the phase error with a resolution of 4 measured values per modulating bit. This corresponds to a sampling rate of approx. 1 MHz.



		Current	Average	Max / Min
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg.Burst Power(Curr)

Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-20 Measurement menu Modulation – Ext. Phase Err. GMSK

Test Settings

The *Analyzer Level, Analyzer Settings*, *Generator,* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.9). The following softkeys and hotkeys differ from the *Power* measurement:

Ext. Phase Err. GMSK

The *Ext. Phase Err. GMSK* softkey controls the GMSK modulation measurement and indicates its status *(RUN | HLT | OFF).*

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. It can be set independently for all *Modulation* applications.

The active application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Note: *The abbreviation "Ext." in* Ext. Phase Err. GMSK *denotes an "Extended" modulation measurement including the quantities* I/Q Origin Offset *and* I/Q Imbalance. *In remote control, the phase and frequency error can be determined separately to speed up the measurement; see test oject* `MODulation[:PERRor]`.

Remote control

```
INITiate:MODulation:XPERror[:GMSK]
ABORt:MODulation:XPERror[:GMSK]
STOP:MODulation:XPERror[:GMSK]
CONTinue:MODulation:XPERror[:GMSK]
```

Measurement configuration

Pressing the *Ext. Phase Err. GMSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.49 ff). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement and the *Trig. Slot Offset* hotkey are associated to the *Ext. Phase Err. GMSK* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *P/t Normal GMSK* on page 4.11 f.); they are identical with the parameters set in the *Control* tab of the *Modulation Configuration* menu (see page 4.49 ff).

The *Ext. Phase Err. GMSK* hotkey bar contains two additional hotkeys:

Disp. Mode

The *Disp. Mode* hotkey selects one of the following display modes:

Current	Measured value for current burst
Minimum/Maximum	Extreme value of a number of bursts
Average	Average value of a number of bursts

See section *Measurement Control (Modulation Configuration – Control)* on page 4.49 ff.

Remote control
No display mode set explicitly, the three measurement curves are accessible via

```
FETCh:ARRay:MODulation:XPERror[:GMSK][:BURSt]
   [:CURRent]?
FETCh:ARRay:MODulation:XPERror[:GMSK][:BURSt]:MMAX?
FETCh:ARRay:MODulation:XPERror[:GMSK][:BURSt]
   :AVERage?
```

etc.

Decode

The *Decode* hotkey defines whether guard or tail bits are decoded or not.

See section *Measurement Control (Modulation Configuration – Control)* on page 4.49 ff.

Remote control

```
CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode
   STANdard | GTBits
```

Application

The *Application* softkey selects the modulation scheme. Only one application of the *Modulation* menu is related to GMSK modulated signals. The 8PSK applications are described in section *Test Settings* on p. 4.44 f.

Phase Err. GMSK

The *Phase Error GMSK* hotkey selects the extended phase error measurement on GMSK modulated signals.

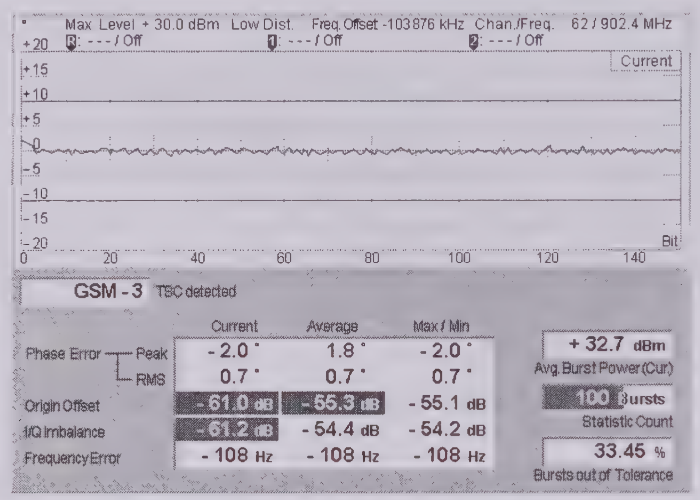
Remote control
The *Phase Error GMSK* application is selected by the keywords `XPERror[:GMSK]` in the 3rd and 4th level of the `MODulation` commands, e.g.
`CONFigure:MODulation:XPERror[:GMSK]...`

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The values are indicated in a parameter line, the test diagram and a tabular overview below:



Parameter line 1,2

Test diagram

Output fields and table

Max Level + 30.0 dBm Low Dist. Freq.Offset -103876 kHz Chan./Freq. 62 / 902.4 MHz

R: - - - / Off 1: - - - / Off 2: - - - / Off

GSM - 3 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

Avg. Burst Power (Cur): + 32.7 dBm

Statistic Count: 100 Bursts

Bursts out of Tolerance: 33.45 %

Fig. 4-21 Display of results (Modulation – Ext. Phase Err. GMSK)

Settings/ Scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st parameter line The first parameter line contains the following settings:

Max. Level	Maximum input level set as in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.70 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

Remote control
The settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

Output fields and table The output fields display the following scalar values:

TSC detected	Detected training sequence of the current burst received from the mobile station *(GSM 0 to 7* or *Dummy* or *"---")*, see *Analyzer* tab, section *Table-Oriented Version* on p. 4.70 ff.
Avg. Burst Power	Average power of current burst (irrespective of the display mode selected and of the current measurement curve),
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle.
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits.

The following scalar values are calculated for the current burst first. From the current results the average over a statistics cycle (*Average*) and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Phase Error Peak	Maximum phase error
Phase Error RMS	Effective phase error (RMS-averaged over the burst)
Origin Offset	Origin offset in the I/Q constellation diagram; calculated in analogy to 8PSK modulation (see Fig. 4-23 on page 4.43 and Equation 4-1)
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal see (see Fig. 4-23 on page 4.43 and Equation 4-2)
Frequency Error	Frequency error

Remote control

```
READ[:SCALar]:MODulation:XPERror[:GMSK]?
FETCh[:SCALar]:MODulation:XPERror[:GMSK]?
SAMPle[:SCALar]:MODulation:XPERror[:GMSK]?

CALCulate:MODulation:XPERror[:GMSK]:LIMit:MATChing?
```

Measurement curves (arrays)

The continuous measurement curve in the test diagram shows the phase error in the burst (in degrees) as a function of time (in bits). The display mode *(Current, Max./Min., Average)* for the measurement curve is indicated in the upper right corner of the diagram.

The scale of both axes is fixed. The measurement curve comprises the whole useful part of the normal burst (bit 0 to 146 ¾). The curve is derived from 588 equidistant measurement points with a ¼ bit spacing. The y-axis ranges from –20° to +20°.

Due to the definition of the phase error (see shaded section on page 4.37), the phase error oscillates around the center of the diagram: The 0° line is equal to the regression line of the phase error trajectory calculated using the Mean Square Error method.

The two colored, horizontal lines in the test diagram mark the selected tolerance range of the phase error.

Remote control

```
READ:ARRay:MODulation:XPERror[:GMSK][:BURSt]...?
FETCh:ARRay:MODulation:XPERror[:GMSK][:BURSt]...?
SAMPle:ARRay:MODulation:XPERror[:GMSK][:BURSt]...?
```

Measurement Menu (Modulation – 8PSK)

If the 8PSK modulation scheme is selected (see *Application* softkey in section *Test Settings* on page 4.38 ff), the graphical measurement menu *Modulation* displays quantities characterizing the 8PSK modulation accuracy.

- The measurement control softkey *Overview 8PSK* (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) indicates the measurement status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the *Power* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.9.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-MS Non Signalling* using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Quantities characterizing the 8PSK modulation accuracy are determined as follows:

The actual modulation vector of the received signal from the mobile station is measured over the complete burst and stored. From a comparison of this measured modulation vector with the (computed) ideal signal vector, three non-redundant quantities are calculated (see Fig. 4-22):

Phase error	Difference in phase between the measured and the ideal signal vector.
Magnitude error	Difference between the magnitudes of the measured and the ideal signal vector.
Error vector magnitude	Magnitude of the vector connecting the measured and the ideal signal vector. In contrast to the previous quantities, the error vector magnitude cannot be negative.

These three quantities are calculated as a function of time and displayed over the whole useful part of the burst (symbol 6 to symbol 162), each of them in a separate graphical measurement menu. In addition, the peak and RMS values of all three quantities are calculated (over the whole display range or over the first ten symbols only) and displayed.

Finally, the *Modulation* measurement provides the following scalar quantities:

95th percentile	Limit value below which 95% of the values of a measurement curve are located. The 95th percentile of a measured quantity has the same unit as the quantity itself. In the 8PSK modulation measurement, the CMU determines 95th percentiles of the Error Vector Magnitude, the Magnitude Error, and the Phase Error.
Origin offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband signal (see Fig. 4-23 on page 4.43 and Equation 4-1). The origin offset corresponds to an RF carrier feedthrough.
I/Q imbalance	Amplitude difference between the in-phase (I) to the quadrature (Q) components of the measured signal, normalized and logarithmized (see Fig. 4-23 on page 4.43 and Equation 4-2). The I/Q imbalance corresponds to an unwanted signal in the opposite sideband.
Frequency error	Difference of the measured frequency from the expected frequency.

For the **tolerance check** all three phase error curves can be fitted into a tolerance template and checked.

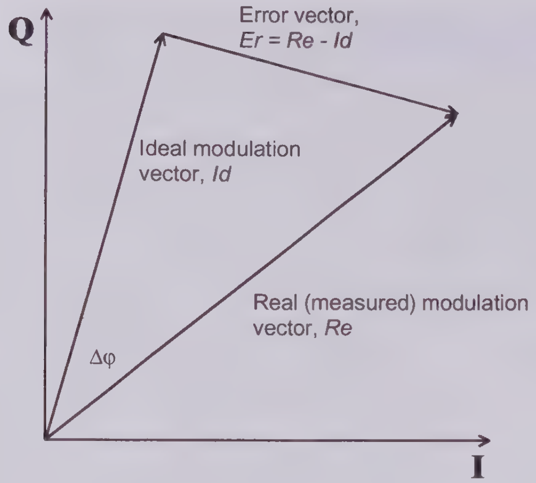


Fig. 4-22 Modulation errors in the I/Q vector diagram

The I/Q vector diagram shows the following quantities measured in the *Modulation* menu:

$\mid Er \mid = \mid Re - Id \mid$	Error vector magnitude (EVM)
$\Delta\varphi$	Phase error
$\mid Re \mid - \mid Id \mid$	Magnitude error

The measurement diagrams show the relative magnitude error and the relative EVM, i.e. the quantities defined above divided by the magnitude of the ideal modulation vector | *Id* |.

Note: *The test functionality of the CMU is beyond the requirements of the standard where nothing regarding the phase error and magnitude error is specified.*

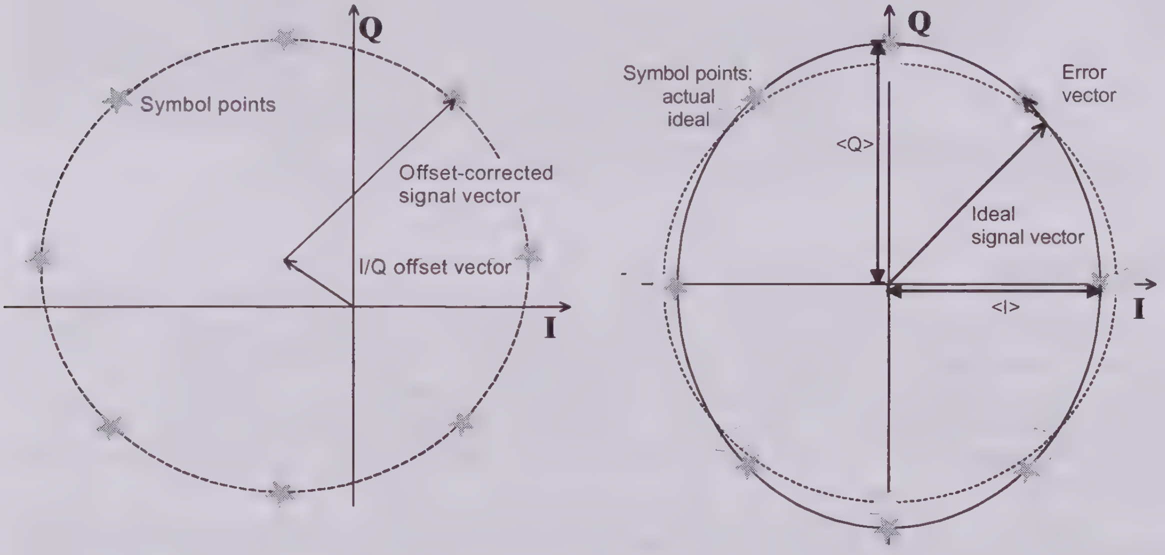


Fig. 4-23 Modulation errors in the I/Q constellation diagram

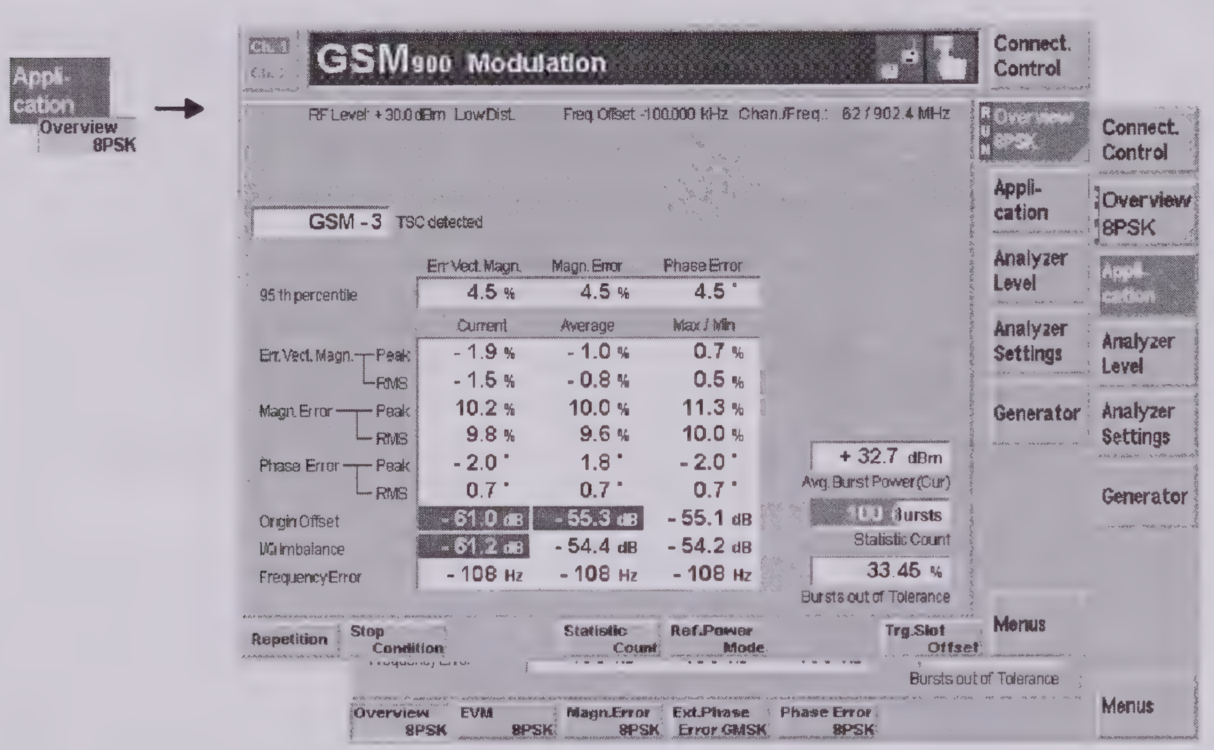
Fig. 4-23 is an idealized representation of the modulation errors where the effect of a pure origin offset (left diagram) and of a pure I/Q imbalance (right diagram) are completely disentangled. The I/Q offset in dB is the logarithmic ratio of the I/Q offset vector (i.e. the estimated DC-offset of the measured signal) to the average offset-corrected signal vector:

$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset-corrected signal vector}|} \qquad \text{(Equation 4-1)}$$

In Equation 4-1, |Offset-corrected signal vector| denotes the magnitude of the offset-corrected signal vector averaged over all constellation points. The average is evaluated according to the prescription given in the annex of standard GSM 05.05.

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signals, which are normalized and logarithmized as follows:

$$\text{I/Q Imbalance} = 20\log\frac{|<\text{I}> - <\text{Q}>|}{|<\text{I}> + <\text{Q}>|} \qquad \text{(Equation 4-2)}$$



RF Level +30.0 dBm LowDist. Freq.Offset -100.000 kHz Chan./Freq.: 62 / 902.4 MHz

GSM - 3 TSC detected

	Err.Vect.Magn.	Magn. Error	Phase Error
95 th percentile	4.5 %	4.5 %	4.5 °

		Current	Average	Max / Min
Err.Vect. Magn.	Peak	- 1.9 %	- 1.0 %	0.7 %
	RMS	- 1.5 %	- 0.8 %	0.5 %
Magn. Error	Peak	10.2 %	10.0 %	11.3 %
	RMS	9.8 %	9.6 %	10.0 %
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg. Burst Power (Cur)

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-24 Measurement menu Modulation – Overview 8PSK

Test Settings

The *Analyzer Level, Analyzer Settings, Generator,* and *Menus* test settings are identical with those in the *Power* menu (see section *Test settings* on page 4.9). The *Overview 8PSK* measurement control softkey (which changes to *EVM 8PSK, Magn. Error 8PSK,* or *Phase Error 8PSK* if the corresponding application is selected) is analogous to the *Ext. Phase Err. GMSK* softkey described in section *Test Settings* on page 4.38. With 8PSK modulation, the *Application* softkey provides the following applications:

Application

The *Application* softkey selects the measurement application and the modulation scheme. Several applications of the *Modulation* menu are related to 8PSK modulated signals. The GMSK application is described in section *Test Settings* on p. 4.38 f.

Overview 8PSK

The *Overview 8PSK* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement Menu (Modulation – 8PSK)* on page 4.41.

Remote control
No explicit switchover command. All *Overview 8PSK* measurements are identified by the 3rd/4th level keywords `...OVERview:EPSK...`

EVM 8PSK

The *EVM 8PSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the mobile station and the ideal signal vector at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.41. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *EVM 8PSK* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:EPSK...`

Phase Err. 8PSK

The *Phase Error 8PSK* hotkey selects the phase error of the modulation vector to be displayed.

The phase error is the difference in phase between the measured signal from the mobile station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)* on page 4.41.

Remote control
No explicit switchover command. All *Phase Error 8PSK* measurements are identified by the 3rd/4th level keywords `...PERRor:EPSK...`

Magn. Err. 8PSK

The *Magnitude Error 8PSK* hotkey selects the magnitude error of the modulation vector to be displayed.

The magnitude error is the difference in magnitude between the measured signal from the mobile station and an ideal signal waveform at the symbol points, see explanation in section *Measurement Menu (Modulation – 8PSK)*. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *Magn. Error 8PSK* measurements are identified by the 3rd/4th level keywords `...MERRor:EPSK...`

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (traces plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no trace. The measurement menus for the remaining three applications are analogous to each other and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity.

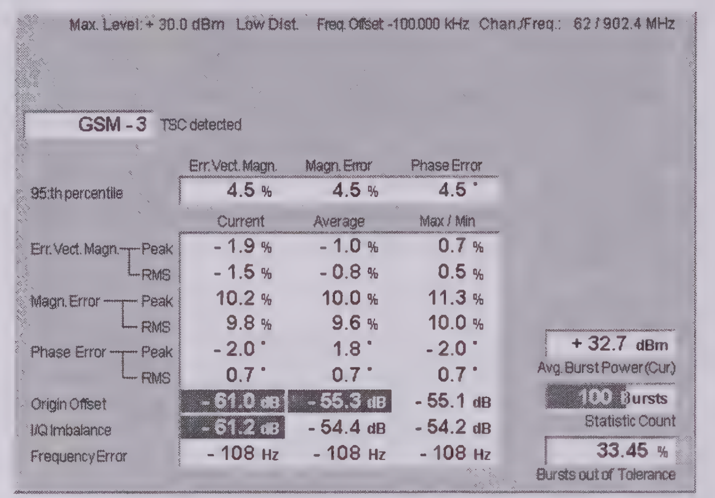
a) Scalar Results (Overview)

The measurement menu for the application *Overview 8PSK* shows all scalar results. Most of the values are indicated in tabular form:

Parameter line

Output fields

Output table
and additional fields



Max. Level: + 30.0 dBm Low Dist. Freq. Offset -100.000 kHz Chan./Freq.: 62 / 902.4 MHz

GSM - 3 TSC detected

	Err. Vect. Magn.	Magn. Error	Phase Error
95:th percentile	4.5 %	4.5 %	4.5 °

		Current	Average	Max / Min
Err. Vect. Magn.	Peak	- 1.9 %	- 1.0 %	0.7 %
	RMS	- 1.5 %	- 0.8 %	0.5 %
Magn. Error	Peak	10.2 %	10.0 %	11.3 %
	RMS	9.8 %	9.6 %	10.0 %
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg. Burst Power (Cur)

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-25 Display of results (Modulation – Overview)

Parameter line The parameter line contains the following settings:

Max. Level	Maximum expected input level set as in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.70 ff.),
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*,
Freq. Offset	Frequency offset with respect to the nominal channel frequency,
Chan./Freq.	RF channel measured and associated frequency.

Remote control The settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

Output fields In the output fields in the center of the menu, the following results are displayed:

TSC detected	Detected training sequence of the current burst received from the mobile station *(GSM 0 to 7* or *Dummy* or *"---")*, see *Analyzer* tab, section *Table-Oriented Version* on p. 4.70 ff.
95th percentile	Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.

Output table The scalar values in the output table are explained at the beginning of this section on page 4.42. They are first calculated for the current burst. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS[1] values are taken over the whole useful part of the burst.

Error Vect. Magn.	Peak and effective (RMS averaged) value of the relative error vector magnitude

---

[1] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

Magn. Error	Peak and RMS (relative) magnitude error
Phase Error	Peak and RMS phase error
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Additional fields Three output fields to the right of output table indicate the following results and settings:

MS Power	Average power of current burst (irrespective of the display mode selected and of the trace in the other 8PSK applications).
Statistic Count	Length of bursts per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits.

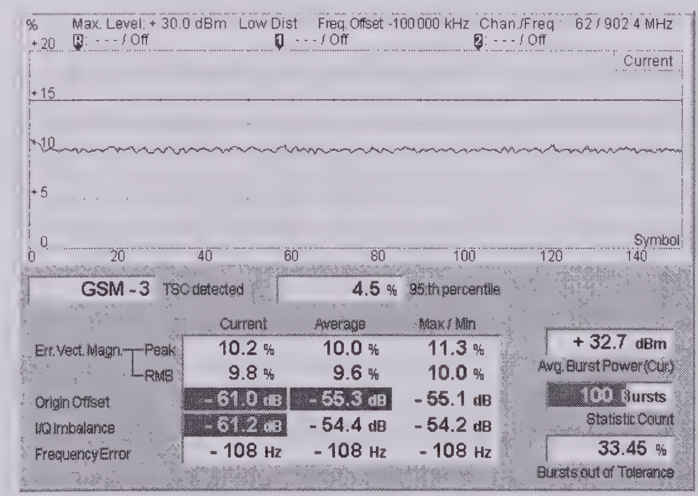
Limit Check A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.51.

Remote control The settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

```
READ[:SCALar]:MODulation:OVERview:EPSK? etc.
CALCulate[:SCALar]:MODulation:OVERview:EPSK:
  LIMit:MATChing?
```

b) Test Diagrams (EVM, Phase Error, Magn. Error)

The graphical measurement menus for the three applications *EVM 8PSK*, *Magn. Error 8PSK*, and *Phase Error 8PSK* are analogous. The results are indicated in two parameter lines, the test diagram, and a tabular overview below:



Parameter lines

Test diagram

Output fields

and table

Max. Level: + 30.0 dBm Low Dist Freq. Offset -100 000 kHz Chan./Freq 62 / 902 4 MHz

R: - - - / Off 1 - - - / Off 2: - - - / Off

GSM - 3 TSC detected

4.5 % 95 th percentile

	Current	Average	Max / Min
Err. Vect. Magn. Peak	10.2 %	10.0 %	11.3 %
Err. Vect. Magn. RMS	9.8 %	9.6 %	10.0 %
Origin Offset	- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance	- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error	- 108 Hz	- 108 Hz	- 108 Hz

+ 32.7 dBm Avg. Burst Power (Cur.)

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-26 Display of results (Modulation – EVM / Phase Error / Magn. Error)

Settings/ Scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

Parameter line

The first parameter line contains the following settings:

Max. Level	Maximum input level set as in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.70 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

Remote control

The settings are retrieved using the query corresponding to the setting command (setting command with appended question mark).

Output fields

Below the diagram, the following results are displayed:

TSC detected	Detected training sequence of the current burst received from the mobile station *(GSM 0 to 7* or *Dummy* or *"---")*, see *Analyzer* tab, section *Table-Oriented Version* on p. 4.70 ff.
95th percentile	Limit values below which 95% of the measured *Error Vector Magnitudes, Magnitude Errors,* and *Phase Errors* in the current burst are located. Owing to this definition, the 95th percentile of a measured quantity has the same unit as the quantity itself.

Output table

The output table contains the following scalar values:

Avg. Burst Power	Average power of current burst (irrespective of the display mode selected and of the current trace),
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle,
Bursts out of Tolerance	Percentage of bursts that violate the tolerance limits.

The following scalar values are calculated for the current burst first. From the current results the average referenced to a statistics cycle (*Average,* see averaging prescription in Chapter 3, section *General Settings)* and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Err. Vect. Magn. (Peak)	Maximum EVM (application *EVM 8PSK* only)
Err. Vect. Magn. (RMS)	Effective EVM (RMS-averaged over the burst)
Magn. Error (Peak)	Maximum magnitude error (application *Magn. Err. 8PSK* only)
Magn. Error (RMS)	Effective magnitude error (RMS-averaged over the burst)
Phase Error (Peak)	Maximum phase error (application *Phase Err. 8PSK* only)
Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Peak and RMS values are specific to the current application *(Phase Error, Magnitude Error* or *Error Vector Magnitude)*. For an explanation of all quantities measured refer to the beginning of this section on page 4.42.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *TX Tests* configuration menu, see p. 4.51.

Remote control

`READ[:SCALar]:MODulation:EVMagnitude:EPSK` etc.

```
CALCulate[:SCALar]:MODulation:EVMagnitude:EPSK
   :LIMit:MATChing?
```

Traces (arrays) The continuous trace in the test diagram shows the measured quantity as a function of time (in symbols). The display mode *(Current, Max./Min., Average)* for the trace is indicated in the upper right corner of the diagram.

The measurement curve comprises the whole useful part of the normal burst (bit 0 to 146 ¾). The curve is derived from 588 equidistant measurement points with a ¼ bit spacing. The y-axis range is fixed for any of the three measured quantities (applications):

0 % to +20 %	for the error vector magnitude
–20 % to +20 %	for the magnitude error
–20 deg to +20 deg	for the phase error

The red, horizontal lines in the test diagram mark the tolerance range of the measured quantities as set in the *Limits* tab of the *Modulation Configuration* menu (see p. 4.51 ff).

Remote control

`READ:ARRay:MODulation:EVMagnitude:EPSK:CURRent?` etc.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration.* contains three tabs to determine the parameters of the phase and frequency error measurement including the error tolerances.

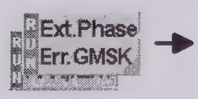
The popup menu *Modulation Configuration* is activated by pressing the measurement control softkey (labeled *Ext. Phase Err. GMSK, Overview 8PPSK, ...* depending on the modulation scheme and application selected) in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

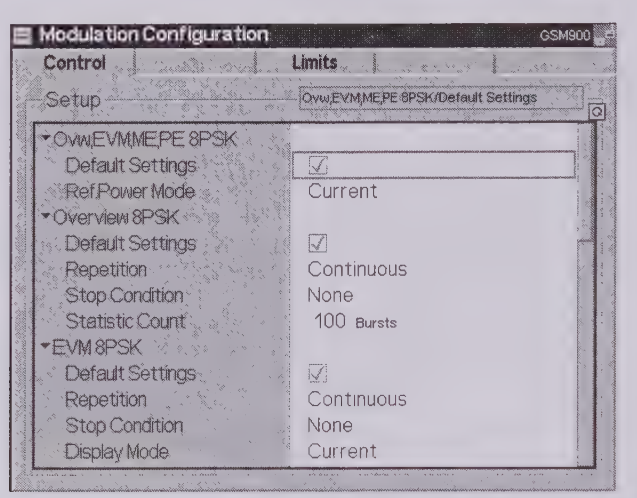
Measurement Control (Modulation Configuration – Control)

The *Control* tab controls the *Modulation* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*, not for application *Overview 8PSK)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*,
- The decoding prescription for guard and tail bits *(Decode*, for GMSK modulation only)
- The averaging prescription to obtain the reference power *(Ref. Power Mode*, for *8PSK* measurements only)

Besides, it influences the graphical measurement menus by adding or removing the *Grid*.





Setup: Ovw,EVM,ME,PE 8PSK/Default Settings

- Ovw,EVM,ME,PE 8PSK
  - Default Settings ☑
  - Ref.Power Mode: Current
- Overview 8PSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition: None
  - Statistic Count: 100 Bursts
- EVM 8PSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current

Fig. 4-27 Modulation Configuration – Control

The settings can be defined separately for the different applications of the *Modulation* measurement group. Most functions comply with those of the menu *Control* in the menu group *Power* (see page 4.27). In the remote-control commands, the keyword `POWer` is to be replaced by `MODulation`. The following parameters are specific to the *Modulation* measurement:

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault ON | OFF`
`etc.`

Display Mode

The *Display Mode* field defines which of the measured and calculated measurement curves is displayed. The measurement curves differ in the way the measured quantity at a fixed point in time *t* is calculated if the measurement extends over several bursts

Current	Measured value for the current burst
Max./Min.	Extreme value over a number of bursts
Average	Average value over a number of bursts

The number of bursts for the calculation of the statistic values *Minimum/Maximum* and *Average* – and thus the result – depends on the repetition mode set (see section *Measurement Control (Power Configuration – Control)* on page 4.27). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the averaging prescription in Chapter 3, section *General Settings*.

In a power measurement absolute values are determined, whereas the measured phase error can have both positive or negative sign. To assess the phase error only the magnitude (and not the sign) is of importance so that extreme values are output in the menu *Modulation* instead of maxima and minima.

Remote control
no display mode set, the four measurement curves are accessible via

```
FETCh:ARRAy:MODulation:XPERror[:GMSK][:BURSt]
   [:CURRent]?
FETCh:ARRAy:MODulation:XPERror[:GMSK][:BURSt]:MMAX?
FETCh:ARRAy:MODulation:XPERror[:GMSK][:BURSt]
   :AVERage? etc.
```

Decode The *Decode* hotkey defines whether guard or tail bits are decoded or not.

Guard and tail bits are located at the beginning and the end of a normal burst (see Fig. 4-38), which is why they also affect the phase error at the beginning and the end of the useful information and therefore the frequency error. The CMU offers two settings:

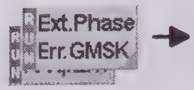
Standard	Guard and tail bits are assumed to be in line with GSM. If the mobile station does actually not send these bits correctly, large phase errors will be measured at the beginning and end of the useful information.
Guard & Tailbits	Guard and tail bits are also decoded. This avoids excessive phase errors in the case of bursts that do not comply with the standard.

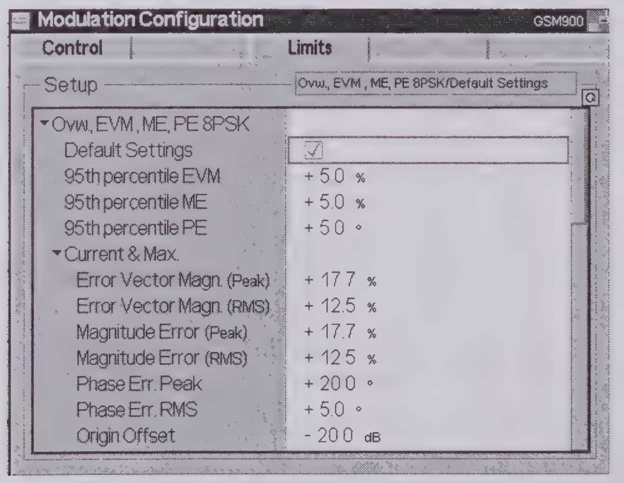
Remote control

```
CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode
  STANdard | GTBits
```

Tolerance Values (Modulation Configuration – Limits)

The *Limits* tab defines upper and lower error limits for the measured values of the *Modulation* measurement.





Ovw., EVM, ME, PE 8PSK/Default Settings

Ovw., EVM, ME, PE 8PSK	
Default Settings	☑
95th percentile EVM	+ 5.0 %
95th percentile ME	+ 5.0 %
95th percentile PE	+ 5.0 °
Current & Max.	
Error Vector Magn. (Peak)	+ 17.7 %
Error Vector Magn. (RMS)	+ 12.5 %
Magnitude Error (Peak)	+ 17.7 %
Magnitude Error (RMS)	+ 12.5 %
Phase Err. Peak	+ 20.0 °
Phase Err. RMS	+ 5.0 °
Origin Offset	- 20.0 dB

Fig. 4-28 Modulation Configuration – Limits

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual modulation schemes are provided.

Remote control

```
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault ON | OFF
etc.
```

Ovw., EVM, ME, PE 8PSK

The *Ovw., EVM, ME, PE 8PSK* table section defines all limits for 8PSK-modulated signals. The limits are set independently for the display modes *Current* and *Max./Min.* on one hand, *Average* on the other hand; see section *Measurement Control (Modulation Configuration – Control)* on page 4.49 ff.

95th percentile PE	Upper limit for the phase error below which 95% of all measured phase error values are located
95th percentile ME	Upper limit for the magnitude error below which 95% of all measured relative magnitude error values are located
95th percentile EVM	Upper limit for the relative error vector magnitude below which 95% of all measured EVM values are located
Error Vector Magn.	Upper limits for the (peak and RMS-averaged[2]) relative error vector magnitude (EVM). Both entries are positive.
Magnitude Error	Upper limits for the absolute value of the (peak and RMS) relative magnitude error. Both entries are positive; the limits for the peak magnitude error define a tolerance mask symmetric to the origin.
Phase Error	Upper limits for the absolute value of the (peak and RMS) phase error. Both entries are positive; the limits for the peak phase error define a tolerance mask symmetric to the origin.
Origin Offset	Upper limit for the origin offset in the I/Q constellation diagram.
I/Q Imbalance	Upper limit for the amplitude difference between the in-phase and quadrature components of the signal.
Frequency Error	Upper limit for the difference between the measured and the expected frequency of the signal.

For an explanation of all measured quantities refer to the beginning of this section on page 4.42.

Remote control

```
CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent]  ...
CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage  ...
```

Ext. Phase Error GMSK

The table section *Ext. Phase Error GMSK* defines upper limits for the different GMSK modulation parameters. The limits depend on the display mode of the measurement curve:

Current & Max.	Common limits for the *Current* measurement curve and for the *Minimum/Maximum* curve (including the *Current* and the *Max./Min* scalar results)
Average	Limits for the *Average* measurement curve (including the *Average* scalar results)

For setting of the display mode see section *Measurement Control (Modulation Configuration – Control)* on page 4.49.

The meaning of the error limits is the same for the *Current* or *Minimum/Maximum (Current & Max.)* and the *Average* results:

Phase Error Peak	Maximum phase error
Phase Error RMS	RMS phase error (RMS-averaged over the burst)
Origin Offset	Upper limit for the origin offset in the I/Q constellation diagram.
I/Q Imbalance	Upper limit for the amplitude difference between the in-phase and quadrature components of the signal.
Frequency Error	Average frequency error in the burst

---

[2] To keep the results comparable, RMS averaging was chosen for both positive quantities and quantities with alternating sign. The RMS-averaged EVM is calculated according to the prescription of GSM 05.05.

The *Phase Error Peak* and the *Frequency Error* are quantities with alternating sign; the corresponding limits are symmetric to the origin (i.e. the absolute value of both quantities must fall below the specified positive limit). In contrast to the *Power* measurement where individual limit lines can be switched off, the *Modulation* limit check is always active.

Remote control

```
CONFigure:MODulation:XPERror[:GMSK]:LIMit[:CURRent]
        <PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>
```

Spectrum Measurements

The menu group *Spectrum* comprises the functions for measurement of the off-carrier power originating from the modulation process *(spectrum due to modulation)* and from the bursty nature of the RF signal, i.e. the power ramping up and down *(spectrum due to switching)*. The two spectra are treated as two different applications; they are displayed in two separate graphical measurement menus *Spectrum* (applications *Due to Modulation* and *Due to Switching)*, the popup menu *Spectrum Configuration* is used for configuration of the measurements.

The *Spectrum* measurement serves to measure the amount of energy that spills outside the designated radio channel when the mobile station transmits at variable output power. The measurement is made in the time domain (zero frequency span mode), at a series of frequency points symmetrically distributed around the nominal frequency of the designated channel (see section *Tolerance Values (Spectrum Configuration – Limit* Lines) on page 4.60 ff).

In GSM 05.05 and GSM 11.10, the two *Spectrum* measurements are specified in detail:

- For the *spectrum due to modulation*, the power must be averaged over 50% to 90% of the useful part of the burst, excluding the training sequence, and then averaged again over a given minimum number of bursts.
- For the *spectrum due to switching*, the peak power over a minimum number of bursts must be determined.

Additional requirements concerning the measurement bandwidths are specified.

The *Spectrum* measurements for GMSK and 8PSK modulation are analogous, however, the tolerance values specified in the GSM standard vary depending on the modulation scheme.

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the results of the adjacent channel power measurement.

- The measurement control softkey *Modulation GMSK* (which changes to *Switching GMSK, Modulation 8PSK,* or *Switching 8PSK* when the corresponding application or modulation scheme is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Spectrum Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the *Spectrum* measurement.
- The remaining softkeys to the right of the test diagram are combined with various hotkeys. When a softkey is selected and an associated hotkey pressed, a popup window appears which indicates a setting or enables an entry. The entry of values is described in section *Test Settings* on page 4.3.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *GSMxxxx-MS Non Signalling* using the *Spectrum* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

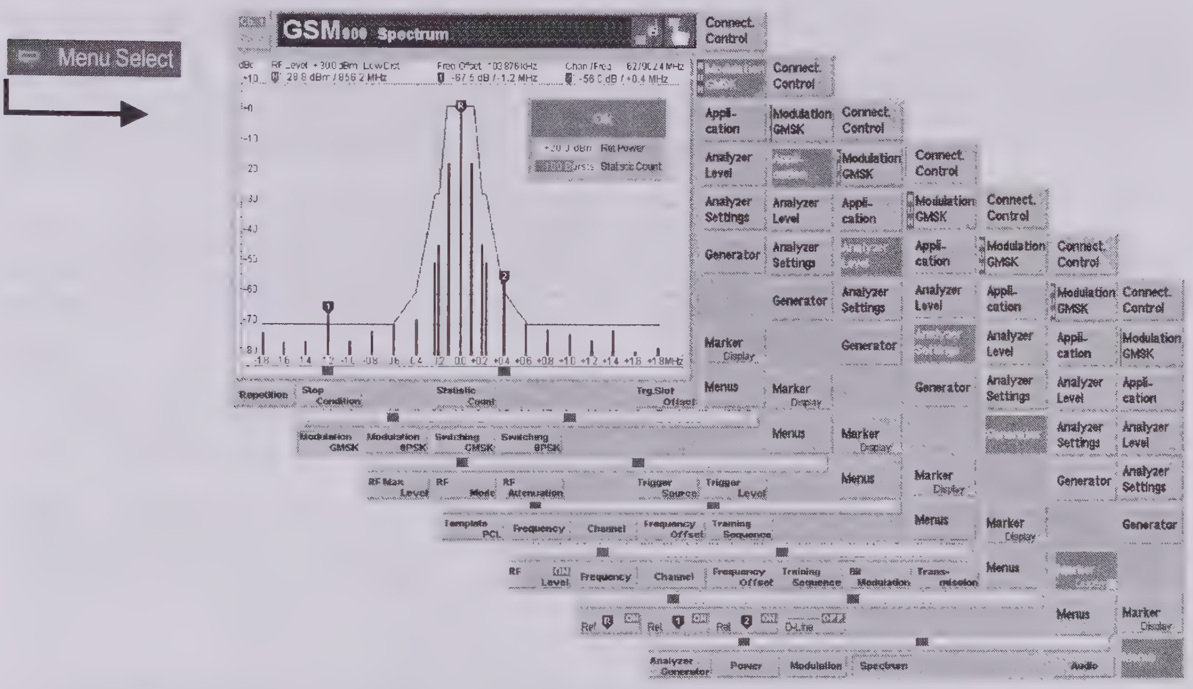


Fig. 4-29 Measurement menu Spectrum due to Modulation

Test Settings

The *Analyzer Level, Analyzer Settings, Generator, Marker,* and *Menus* test settings are identical with those in the *Power* menu (see section *Test settings* on page 4.9). The following softkeys and hotkeys differ from the *Power* measurement:

Modulation GMSK

The *Modulation GMSK* softkey controls the measurement and indicates its status *(RUN | HLT | OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. It can be set independently for all *Spectrum* applications.

The active application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

```
INITiate:SPECtrum:MODulation[:GMSK]
ABORt:SPECtrum:MODulation[:GMSK]
STOP:SPECtrum:MODulation[:GMSK]
CONTinue:SPECtrum:MODulation[:GMSK]
FETCh:SPECtrum:MODulation[:GMSK]:STATus?
```

Measurement configuration

Pressing the *Modulation GMSK* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.49 ff). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement and the *Trig. Slot Offset* hotkey are associated to the *Modulation GMSK* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test settings* on page 4.9); they are identical with the parameters set in the *Control* tab of the *Spectrum Configuration* menu (see page 4.49 ff).

Application

The Application softkey changes the type of spectrum to be measured and the modulation scheme. The two alternative spectra (applications) are displayed in separate measurement menus. When an application is selected, the corresponding measurement menu is called up and the labeling of the measurement control softkey is adapted. The configuration settings for both applications, however, are listed in a common popup menu (see p. 4.59 ff).

Modulation GMSK

The *Modulation GMSK* hotkey selects the spectrum due to modulation for GMSK modulated signals to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 11 neighboring frequencies is displayed in a single graph, see p. 4.57 ff.

Remote control
No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `..SPECtrum:MODulation[:GMSK]`

Modulation 8PSK

The *Modulation 8PSK* hotkey selects the spectrum due to modulation for 8PSK modulated signals to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 11 neighboring frequencies is displayed in a single graph, see p. 4.57 ff.

Remote control
No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `..SPECtrum:MODulation[:EPSK]`

Switching GMSK

The *Switching GMSK* hotkey selects the spectrum due to switching for GMSK modulated signals to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 4 neighboring frequencies is displayed in a single graph, see p. 4.58 ff.

Remote control
No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `...SPECtrum:SWITching[:GMSK]`

Switching 8PSK

The *Switching 8PSK* hotkey selects the spectrum due to switching for 8PSK modulated signals to be displayed. In this mode, the power at the nominal frequency and the relative power at up to 4 neighboring frequencies is displayed in a single graph, see p. 4.58 ff.

Remote control
No explicit switchover command. All spectrum due to modulation measurements are identified by the 2nd to 4th level keywords `...SPECtrum:SWITching[:EPSK]`

Measurement Results

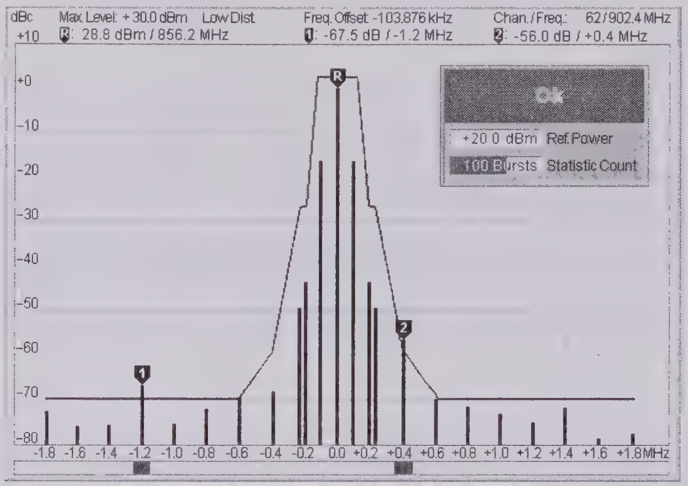
The *Spectrum* measurement menu and the results depend on the type of spectrum (application) selected. The scaling of the x-axis is equal for the two spectra. However, the spectrum due to modulation is expressed in relative units (dBc), the spectrum due to switching in absolute units (dBm).

a) Spectrum due to Modulation

In the *Spectrum due to Modulation* measurement, the average burst power at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagram (bar graph), and an info box.

Parameter lines

Bar graph and info box



dBc Max Level: +30.0 dBm Low Dist Freq. Offset -103.876 kHz Chan./Freq.: 62/902.4 MHz
+10 R: 28.8 dBm / 856.2 MHz 1: -67.5 dB / -1.2 MHz 2: -56.0 dB / +0.4 MHz

Ok
+20.0 dBm Ref.Power
100 Bursts Statistic Count

+0
-10
-20
-30
-40
-50
-60
-70
-80
-1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0.0 +0.2 +0.4 +0.6 +0.8 +1.0 +1.2 +1.4 +1.6 +1.8MHz
R
1
2

Fig. 4-30 Display of results (spectrum due to modulation)

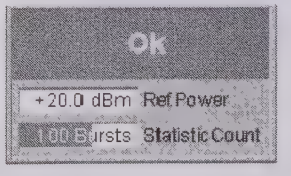
Parameter lines The first parameter line contains the following settings:

Max. Level	Maximum input level set as in *Input Level - Mode*
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

2nd parameter line The second parameter line contains the following marker values:

R	Absolute level (in dBm) and frequency offset from the carrier of reference marker
1	Level (in dBm) and frequency offset of delta marker 1 (setting *absolute*). With setting *relative,* the level difference from the carrier is indicated (same as the diagram units)
2	Level and time of delta marker 2, see delta marker 1

Info box



Ok
+20.0 dBm Ref.Power
100 Bursts Statistic Count

The info box indicates the following settings and scalar results:

Ref. Power	Absolute value of the measured carrier output power of the BTS. According to GSM specifications, the *Ref. Power* is measured with a filter bandwidth of 30 kHz so that it differs from the average burst power determined in the *Power vs. Time* menu.
Statistic Count	Number of bursts per statistics cycle
Burst Matching	Error message if the displayed burst is out of tolerance.

Remote control
The settings are retrieved using the query corresponding to the setting command (setting command with appended question mark). The reference power and burst matching are retrieved with a single command:

```
READ[:SCALar]:SPECtrum:MODulation[:GMSK]?
FETCh[:SCALar]:SPECtrum:MODulation[:GMSK]?
SAMPle[:SCALar]:SPECtrum:MODulation[:GMSK]?
```

Response: `<RefPow>,<Match>`

Bar graph The bar graph shows the current carrier output power of the BTS and the measured spectrum due to modulation at up to 11 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the carrier output power forms the 0 dB reference level. The spectral tolerance mask defined in the *Limit Lines* tab (see p. 4.60 ff) is indicated in addition. The measurement result at particular frequencies can be retrieved by means of markers. The measurement at every single frequency point can be switched on and off in the Meas X tab (see p. 4.65).

Limit Check The upper limit lines defined in the Limit Lines tab of the configuration menu (see p. 4.60 ff) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Remote control

```
READ:ARRay:SPECtrum:MODulation[:GMSK]?
FETCh:ARRay:SPECtrum:MODulation[:GMSK]?
SAMPle:ARRay:SPECtrum:MODulation[:GMSK]?
```

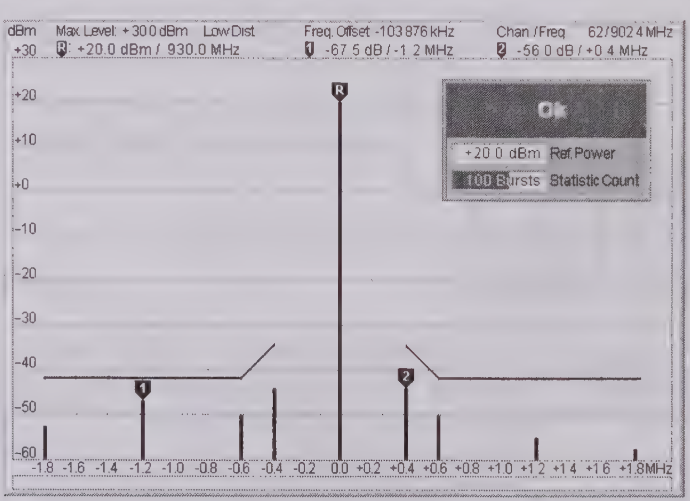
b) Spectrum due to Switching

In the *Spectrum due to Switching* measurement, the maximum level measured at a series of fixed frequency points around the selected RF frequency is displayed. The results and the corresponding settings are indicated in two parameter lines, the test diagram (bar graph), and an info box:

Parameter lines

Bar graph and

info box



dBm Max Level: +30.0 dBm Low Dist Freq. Offset -103.876 kHz Chan./Freq. 62/902.4 MHz
+30 R: +20.0 dBm / 930.0 MHz 1 -67.5 dB / -1.2 MHz 2 -56.0 dB / +0.4 MHz

+20.0 dBm Ref.Power
100 Bursts Statistic Count

Ok
+20
+10
+0
-10
-20
-30
-40
-50
-60
R
1
2
-1.8 -1.6 -1.4 -1.2 -1.0 -0.8 -0.6 -0.4 -0.2 0.0 +0.2 +0.4 +0.6 +0.8 +1.0 +1.2 +1.4 +1.6 +1.8MHz

Fig. 4-31 Display of results (spectrum due to switching)

Supplement to the Operating Manual
GSM400/850/900/1800/1900-MS for CMU-B21

Supplement to the Data Sheet

Dear CMU Customer,

Starting with firmware version V2.15, your CMU is able to perform transmitter tests on 8PSK-modulated channels as described in Chapters 4 and 6 of this manual.

Please note that in case of a firmware update of a CMU unit delivered earlier to firmware V2.15, the accuracy of the 8PSK measurements may not always be in accordance with the values quoted in the data sheet.

Supplement to the Operating Manual

GSM400/850/900/1800/1900-MS for R&S CMU-B21

New Features in Firmware V3.07

Dear CMU Customer,

Your Universal Radio Communication Tester R&S CMU 200 was delivered with firmware V3.07. The new firmware version for the options CMU-K20/-K21/-K22/-K23/-K24 offers a few modifications and extensions that could not yet be reported in the current revision of the operating manual, stock no. 1115.6088.12-10-:

- In the *Limit Lines* tab of the *Power Configuration* menu, a new parameter ***Dynamic Template*** has been introduced to enable or disable the dynamic limit line correction for the entire upper or lower limit line. The dynamic limit line correction modifies the GSM power/time template as a function of the power control level of the mobile phone *(Template PCL* in *Non Signalling* test mode, *PCL* in *Signalling* mode). The CMU provides dynamic limit line corrections for both GMSK and 8PSK-modulated signals.

  Switching off the *Dynamic Template* is equivalent to disabling the dynamic limit line correction in all individual areas of the GSM power/time template. In remote control, this can be done with the following commands:

  ```
  CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer:ALL:DYNamic:ENABle ON | OFF
  CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer:ALL:DYNamic:ENABle ON | OFF
  CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer:ALL:DYNamic:ENABle ON | OFF
  CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer:ALL:DYNamic:ENABle ON | OFF
  ```

- The ***I/Q Imbalance*** can be measured for GMSK-modulated signals but is no longer provided for 8PSK-modulated signals. The output arrays of the following remote-control commands are shortened because the three I/Q Imbalance results (corresponding to the *Current*, the *Average* and the *Max./Min.* evaluation) are no longer returned:

  ```
  READ[:SCALar]:MODulation:OVERview:EPSK?
  FETCh[:SCALar]:MODulation:OVERview:EPSK?
  SAMPle[:SCALar]:MODulation:OVERview:EPSK?
  CALCulate:MODulation:OVERview:EPSK:LIMit:MATChing?

  READ[:SCALar]:MODulation:EVMagnitude:EPSK?
  FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?
  SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?
  CALCulate:MODulation:EVMagnitude:EPSK:LIMit:MATChing?

  READ[:SCALar]:MODulation:PERRor:EPSK?
  FETCh[:SCALar]:MODulation:PERRor:EPSK?
  SAMPle[:SCALar]:MODulation:PERRor:EPSK?
  CALCulate:MODulation:PERRor:EPSK:LIMit:MATChing?

  READ[:SCALar]:MODulation:MERRor:EPSK?
  FETCh[:SCALar]:MODulation:MERRor:EPSK?
  SAMPle[:SCALar]:MODulation:MERRor:EPSK?
  CALCulate:MODulation:MERRor:EPSK:LIMit:MATChing?
  ```

  In the commands defining limits for the modulation measurement, the parameter list is shortened because the upper limit for the I/Q Imbalance (second last parameter) is no longer returned. This affects the following commands:

  ```
  CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent]
  CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage
  ```

- In GSM850 and GSM1900 networks the **Mobile Network Code (MNC)** is a 3-digit number and can be set in the range between 0 and 999. In the other networks, the MNC is a 2-digit number that can be set between 0 and 99. The CMU uses a default MNC of 01 (for GSM400/900/1800) or 010 (for GSM850/1900). This affects the following commands:

  ```
  CONFigure:NETWork:IDENtity:MNC <MNC>
  CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MNC <MNC>
  [SENSe:]MSSinfo:IMSI:MNC?
  ```

- The **Mobile Subscriber Identification Number (MSIN)** comprises 9 digits in GSM850/1900 vs. 10 digits in the other networks. The CMU uses a default MSIN (string parameter) of "100000095" (for GSM400/900/1800) or "1000000095" (for GSM850/1900). This affects the following commands:

  ```
  CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MSIN <MSIN>
  [SENSe:]MSSinfo:IMSI:MSIN?
  ```

Contents

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2 Getting Started

The following chapter presents a sample GSM mobile test with the universal radio communication tester CMU. It is intended to provide a quick overview of the function groups *GSM400/850/900/1800/1900-MS Non Signalling* and *GSM400/850/900/1800/1900-MS Signalling* and their functionality and to lead through some basic tests that are commonly performed on GSM mobile phones.

Before starting any measurement with the CMU, please note the instructions given in chapter 1 of the operating manual for the CMU basic unit for putting the instrument into operation. In chapters 2 to 4 of that manual you will also find information on customizing the instrument and the display according to your personal preferences. For installation instructions for the *GSM400/850/900/1800/1900* software (CMU-K21/-K22/-K23) refer to chapter 1 of the present manual.

The tests reported below include

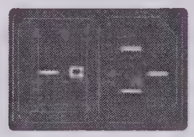
- Connection of the phone and selection of the GSM function group,
- Power and modulation measurements in *Non Signalling* mode,
- Selection and measurement of signalling parameters,
- BER tests.

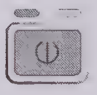
The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements which could not be reported in detail.

The principles of manual operation are discussed in chapter 3. For a systematic explanation of all menus, functions and parameters including GSM background information refer to the reference part in chapter 4.

Preparing a GSM Mobile Phone Test

This chapter describes how to use the CMU for GSM mobile phone tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the CMU basic unit. Furthermore, the GSM software must be properly installed following the instructions given in chapter 1 of the present manual.

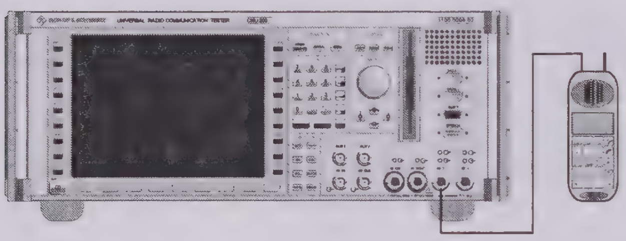




Step 1

- ➢ Switch on the CMU using the mains switch at the rear. ①
- ➢ Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel. ②

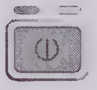
⇓



Step 2

- ➢ Connect the bi-directional RF connector RF 2 of the CMU to the antenna connector of the mobile phone. ③
- ➢ Supply the mobile phone with the correct operating voltage (battery or power supply). ④

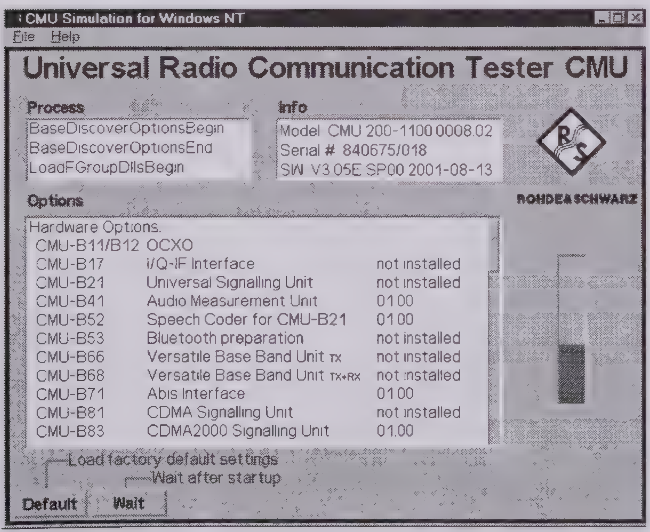
⇓



Step 3

- ➢ Switch on the CMU by means of the *ON/STANDBY* key on the front panel.

⇓



Universal Radio Communication Tester CMU

Process

```
BaseDiscoverOptionsBegin
BaseDiscoverOptionsEnd
LoadFGroupDllsBegin
```

Info

```
Model CMU 200-1100 0008.02
Serial # 840675/018
SW V3 05E SP00 2001-08-13
```

ROHDE&SCHWARZ

Options

```
Hardware Options.
 CMU-B11/B12 OCXO
 CMU-B17      I/Q-IF Interface             not installed
 CMU-B21      Universal Signalling Unit    not installed
 CMU-B41      Audio Measurement Unit       01.00
 CMU-B52      Speech Coder for CMU-B21     01.00
 CMU-B53      Bluetooth preparation        not installed
 CMU-B66      Versatile Base Band Unit TX  not installed
 CMU-B68      Versatile Base Band Unit TX+RX not installed
 CMU-B71      Abis Interface               01.00
 CMU-B81      CDMA Signalling Unit         not installed
 CMU-B83      CDMA2000 Signalling Unit     01.00
```

Load factory default settings
Wait after startup

The startup menu is displayed while the CMU performs a power-up test. ⑤

After a few seconds the CMU displays the last menu used in the previous session.

- ➢ Press the *RESET* key to open the *Reset* popup menu.
- ➢ Select *Reset* and press the *ENTER* key.
- ➢ In the popup window opened, select *Yes* to confirm the instrument reset.

The CMU indicates that it performs a general reset of all device settings and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Mains switch on the rear panel**

When the mains switch at the rear is set to the OFF position, the complete instrument is disconnected from the power supply. When it is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the *ON/STANDBY* key on the front panel.

☞ chapter 1 of CMU manual

② ***ON/STANDBY* key on the front panel**

The *ON/STANDBY* key at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the orange LED (STANDBY) is illuminated.

Operation:
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

... on Step 2

③ **RF connection of the mobile phone**
A high-quality cable should be used for this connection, ideally with an attenuation of less than 0.5 dB. For portable phones, the car installation set supplied by telephone manufacturers can be used.

④ **Power supply for the mobile phone**
In case the mobile phone is operated from an external power supply, make sure that it is capable of supplying the maximum peak current required. As GSM mobile phones generate pulse-like RF signals, they often feature a pulse-shaped current consumption. Problems may arise if power supplies are used which cannot provide such currents with a constant voltage.

The CMU provides two bidirectional RF connectors RF1 and RF2 differing by their permissible input and output levels. RF1 is the recommended standard connector for GSM mobile phones, RF2 for handheld phones (see data sheet).

The unidirectional connectors RF4 IN and RF3 OUT are intended for connection of modules requiring high input levels or modules with low RF output levels. RF4 IN and RF3 OUT can also be used to connect GSM mobiles off the air via antennas.

Input and output connectors can be selected in the *RF* ⊖→ tab of the *Connect. Control* menu.

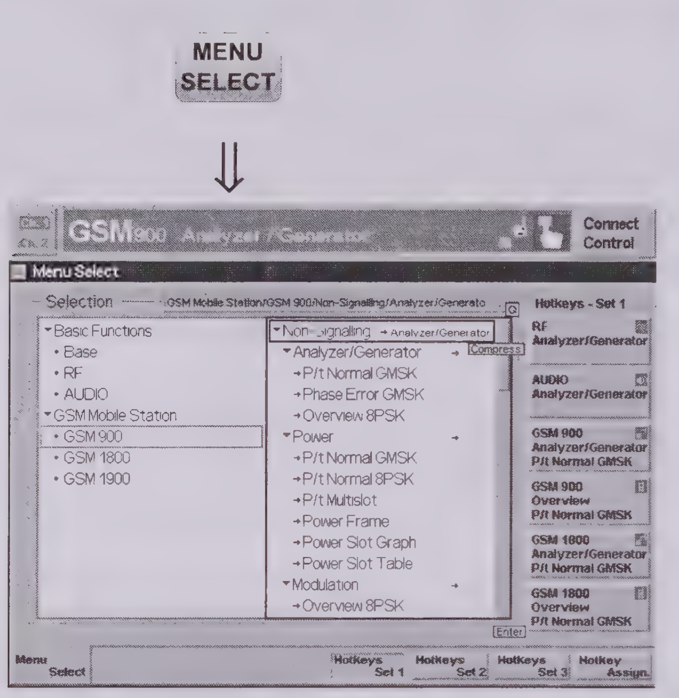
... on Step 3

⑤ **Startup menu**
The startup menu displays the following information:

- The startup procedure *(Process)*
- Instrument model, serial number and version of the CMU base software *(Info)*
- Installed hardware and software options and equipment *(Options)*. Available software options are listed with their version numbers.
- Progress of the startup procedure (*Startup* bar graph).

☞ chapter 4 of CMU manual

That chapter also contains information on customizing the CMU.



Step 4

- ➢ Press the *Menu Select* key to open the *Menu Select* menu.①

The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

- ➢ Select the GSM900-MS function group.
- ➢ Select the *Non-Signalling* mode
- ➢ Select the *Analyzer/Generator* menu.
- ➢ Press the *Enter* key to activate the measurement selected and open the *Analyzer/Generator* menu.

Additional Information...

... on Step 4

① **Menu Select menu**

The *Menu Select* menu shows all function groups installed on your CMU. All function groups GSMxxx-MS are subdivided in the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus.

Alternative Settings and Measurements

☞ chapter 3

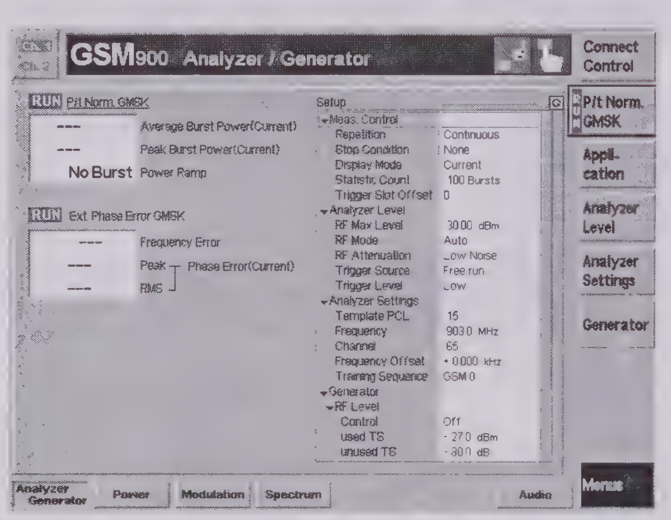
☞ chapter 4

Frequently used measurement menus can be stored together with their function group and mode and assigned to one of the eight hotkeys. When needed for the next time, they can be called up by a single keystroke. See also chapter 4 of the CMU manual.

Non Signalling Mode

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and a RF signal with GSM characteristics can be analyzed. Compared to the *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel and MS output power ranges of the network. The most common application is module test and test of mobiles in a special *test mode*.

In our example we use the GSM signal generated by the CMU itself to demonstrate the main features of the *Non Signalling* mode. This is analogous to the *RF* measurement example in the CMU operating manual.



RUN P/t Norm. GMSK

---	Average Burst Power(Current)
---	Peak Burst Power(Current)
No Burst	Power Ramp

RUN Ext. Phase Error GMSK

---	Frequency Error
---	Peak – Phase Error(Current)
---	RMS – Phase Error(Current)

Setup

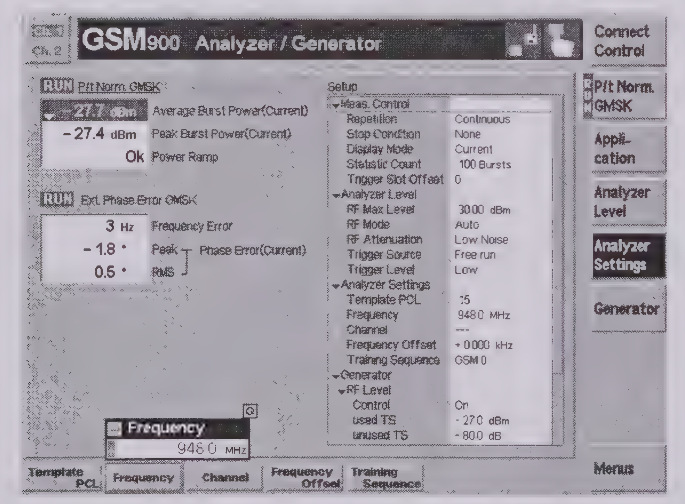
Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	Free run
Trigger Level	Low
Analyzer Settings	
Template PCL	15
Frequency	903.0 MHz
Channel	65
Frequency Offset	+ 0.000 kHz
Training Sequence	GSM 0
Generator	
RF Level	
Control	Off
used TS	- 27.0 dBm
unused TS	- 30.0 dB

Step 1

The *Analyzer/Generator* menu contains softkeys and hotkeys to configure the RF generator signal of the CMU and to define the RF analyzer settings.②

Moreover, the current measurement results for power, frequency and phase errors of the received signal are displayed. ③

At present, all parameters are set to default values. They can be directly changed by means of the softkeys and hotkeys. User-defined parameters will be saved to the non-volatile RAM for later sessions when the CMU is switched off.



RUN P/t Norm. GMSK

- 27.7 dBm	Average Burst Power(Current)
- 27.4 dBm	Peak Burst Power(Current)
Ok	Power Ramp

RUN Ext. Phase Error GMSK

3 Hz	Frequency Error
- 1.8 °	Peak – Phase Error(Current)
0.5 °	RMS – Phase Error(Current)

Frequency 948.0 MHz

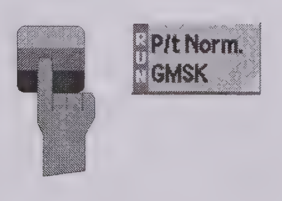
Setup

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	Free run
Trigger Level	Low
Analyzer Settings	
Template PCL	15
Frequency	948.0 MHz
Channel	---
Frequency Offset	+ 0.000 kHz
Training Sequence	GSM 0
Generator	
RF Level	
Control	On
used TS	- 27.0 dBm
unused TS	- 80.0 dB

- ➢ Proceed as outlined in section *RF Non Signalling Measurements*, chapter 2 of CMU200 operating manual to connect RF1 to RF2 via a coax cable. Open the *Connection Control* menu and perform the appropriate RF input and output settings.
- ➢ Adapt the *Analyzer Settings – Frequency* setting to the expected input signal frequency (default generator frequency).
- ➢ Press *Generator – RF Level* and the ON/OFF key to switch on the generator.

The analyzer adapts itself to the RF input level (autoranging). ④

The measurement results are indicated in the *P/t Norm. GMSK* and *Ext. Phase Error GMSK* output fields.



- ➢ Select (press) the *Power/t Norm. GMSK* softkey.

Additional Information...

... on Step 1

② **Analyzer/Generator menu**

The *Analyzer/Generator* menu contains three with associated hotkeys used to

- Define the RF input signal path and the trigger settings *(Analyzer Level)*
- Set the CMU RF analyzer *(Analyzer Settings)* and determine the RF input signal that can be measured
- Control the RF generator *(Generator)* and define the parameters of the RF output signal generated.

The assignment between carrier frequency and channel number is according to GSM specifications. As the CMU simulates a base station, the generator signal corresponds to the downlink (signal direction from the base station towards the mobile station), the signal analyzed corresponds to the uplink (signal direction from the mobile station towards the base station). The channel/frequency assignment changes accordingly.

The RF frequency can be set in multiples of 200 kHz. With an additional *Frequency Offset*, an RF signal with an arbitrary frequency that is in the range supported by the tester can be generated and analyzed.

In general, the RF generator level is set to be different for the used timeslot and unused timeslots. The level of the unused timeslots is defined relative to the level in the used timeslot.

③ **Measurement and Generator State**

The state of the *Power/t Norm. GMSK* measurement is indicated in the corresponding softkey (measurement control softkey) and above the output fields for the results. The state of the RF generator is indicated in the *Generator – RF Level* softkey.

For ongoing measurements, the results in the output fields are constantly updated. All measured quantities refer to the current burst. The default tolerance template for the power ramp is defined according to GSM specifications.

For various reasons, an output field may fail to show a valid measurement result (indication "---"):

- The analyzer settings do not match the properties of the input signal.
- The input signal is missing.
- The measurement is switched off *(OFF* is indicated in the softkey controlling the measurement).

④ **Max. Level**

The autoranging mechanism adjusts the RF input path to the applied signal. Alternatively, the expected signal level (for GMSK-modulated GSM signals, the average RF input level plus an appropriate margin of a few dB) can be set via Analyzer Level – RF Max. Level.

Alternative Settings and Measurements

☞ chapter 4, p. 4.2 ff.

The *Analyzer/Generator* settings are also provided in the *Analyzer* and *Generator* tabs of the *Connection Control* menu. See also notes on *Softkeys and hotkeys* on p. 2.11.

Selecting a definite training sequence (TSC) or bit modulation or transmission mode in the *Generator Modulation* panel implies that signals with these characteristics are generated.

Selecting a definite TSC in the *Analyzer Settings* panel implies that only signals with this TSC are analyzed.

The current options for the measurement status are *ON* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see below).

Once selected, the *Power* or *Modulation* measurement can be switched off and on again by means of the toggle key *ON/OFF*.

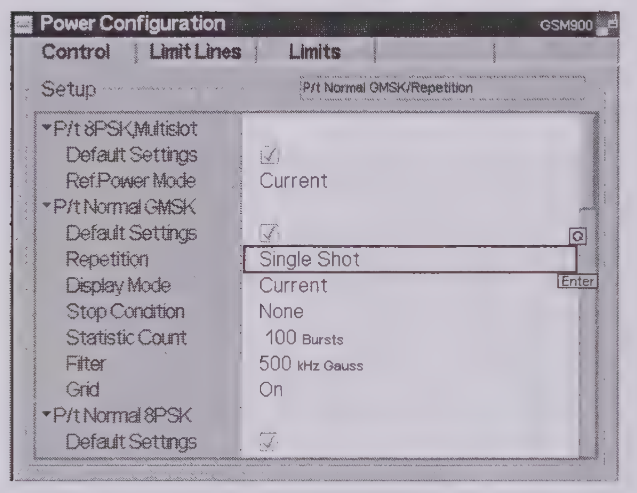
Generators may also be switched on (state *ON)* and off (state *OFF)* by means of the *ON/OFF* key.

☞ Chapter 4, p. 4.72 ff.

The permissible range *Max. Level* depends on the RF connector and the external attenuation used.

Step 2

- ➢ Press the selected *Power/t Norm. GMSK* softkey again to call up the *Power Configuration* menu.



Setup: P/t Normal GMSK/Repetition

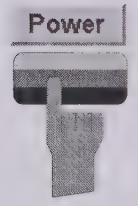
- P/t 8PSK Multislot
  - Default Settings: ☑
  - Ref.Power Mode: Current
- P/t Normal GMSK
  - Default Settings: ☑
  - Repetition: Single Shot
  - Display Mode: Current
  - Stop Condition: None
  - Statistic Count: 100 Bursts
  - Filter: 500 kHz Gauss
  - Grid: On
- P/t Normal 8PSK
  - Default Settings: ☑

In the *Control* tab, the *Power Configuration* menu defines the scope of the *Power* measurement. The settings offered in this menu are discussed in section *General Settings* in chapter 3. We pick just one example, limiting the number of bursts measured.①

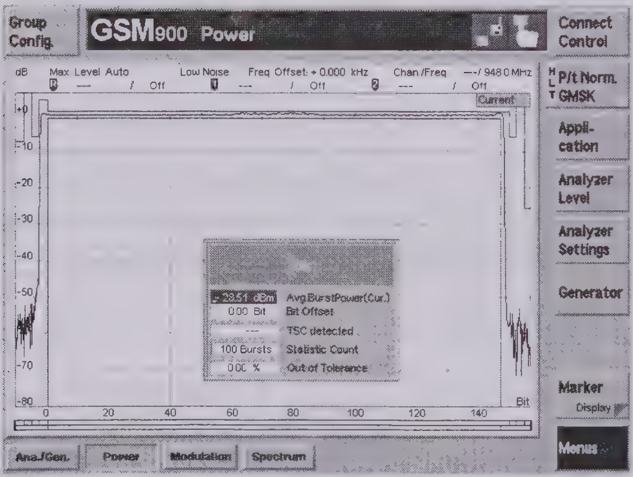
- ➢ Press the *ON/OFF* key or the rotary knob to expand the table.
- ➢ Select *Single Shot* in the *Repetition* line.②
- ➢ Press the *ESCAPE* key or the *Power* softkey again to close the *Power Configuration* menu and return to the main menu.

The *Power* measurement is stopped after one statistic count. The status indication next to the *Power* softkey is set to *HLT*.③

Step 3



- ➢ Press the *Power* hotkey to switch over to the graphical menu *Power*.



-23.51 dBm Avg.BurstPower(Cur.)
0.00 Bit Bit Offset
--- TSC detected
100 Bursts Statistic Count
0.00 % Out of Tolerance

The *Power* menu shows the power of the current burst as a function of time. ④

Together with the burst power, a tolerance template as specified in the GSM standard (here: for GMSK-modulated normal bursts) is displayed. Settings (at present, the default settings) and scalar results are displayed in two parameter lines above the diagram and in a message box positioned in the center of the diagram.

Various tools allowing to take a closer look at the measurement results are provided in the graphical measurement menu.

Additional Information...

... on Step 2

① **Power Configuration menu**

The *Power Configuration* menu contains three tabs defining

- Measurement control and statistical settings *(Control),*
- The tolerance template for the burst *(Limit Lines),*
- PCL-dependent limits for the average burst power *(Limits)*

② **Repetition mode and Stop Condition**

If no stop condition is imposed *(Stop Condition = None),* the *Repetition* mode determines whether the measurement is

- Continued until explicitly stopped by the operator *(Continuous),*
- Stopped after one statistic count *(Single Shot).*

By default, a statistic count comprises 100 bursts. With *Stop Condition = On Limit Failure*, the measurement is stopped after the first burst which is out of tolerance.

③ **Measurement in the HLT state**

The average and peak power of the last burst measured is indicated in the output fields *Average* and *Peak*.

In contrast, the modulation measurement is still running. The results for the frequency and phase errors are periodically updated.

... on Step 3

④ **Power menu**

The diagram in the *Power* menu, application *Power/t Norm. GMSK* shows a normal burst with a length of 148 bits (plus a guard period of 8.25 bits). The time scale of the diagram ranges from –10 bits to 156¾ bits covering the useful part, the rising and falling edges of the burst. The ordinate ranges from –80 dB to +10 dB, the 0-dB reference level is equal to the carrier power.

Note that settings made previously (*Power Configuration* menu) are preserved in the whole measurement group. Accordingly, the status of the measurement is still *HLT*. The diagram is fixed showing the last burst measured.

Alternative Settings and Measurements

☞ chapter 3.

Settings made in the *Power Configuration* menu apply to power measurements only.

Settings made in the *Connect. Control* menus apply to the entire function group and mode *GSM900-MS Non Signalling*.

☞ chapter 3.

The *Statistic Count* is defined in the *Control* tab of the *Power Configuration* menu.

The stop condition *On Limit Failure* should be selected if the limit check represents the main purpose of the measurement.

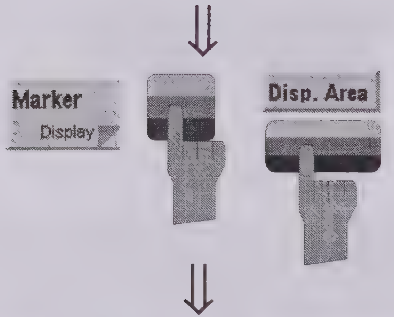
The limits can be modified in the *Limit Lines* tab of the *Power Configuration* menu.

☞ CMU manual

See the sections on measurement control in chapter 3 and 5.

☞ chapter 4, p. 4.9 ff.

The GSM power template is defined relative to the carrier power. For low signal powers, a looser absolute limit is to be applied at the beginning and the end of the power ramp (areas 1, 2, 7, and 8). This yields the distorted template that we observe in the present example.



Step 4

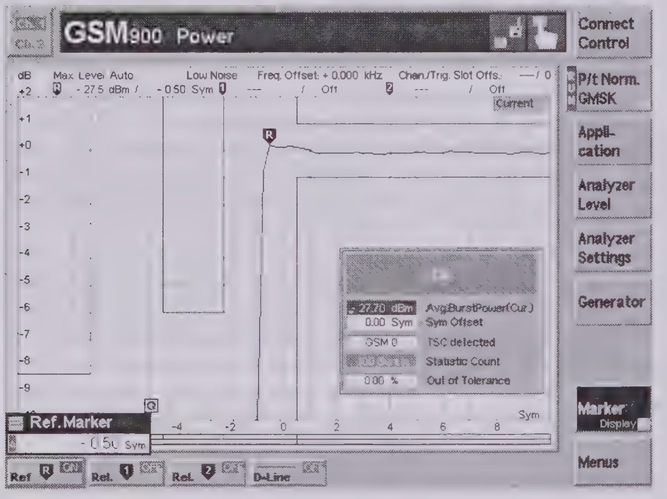
- ➢ Press the *Marker/Display* softkey twice to change the hotkeys displayed below the diagram.①
- ➢ Press the *Display Area* hotkey to open a window offering a list of different zoom areas.

If you select *Left Upper Corner* the CMU zooms in on the left upper corner of the burst.

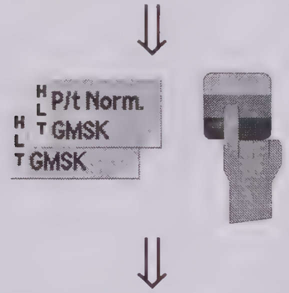
- ➢ Press the *Display/Marker* softkey twice and the *Ref R* hotkey. Enter an abscissa value (in bits) to position a reference marker onto the trace.②

The coordinates (time and burst power) of the reference marker are displayed in the second parameter line.

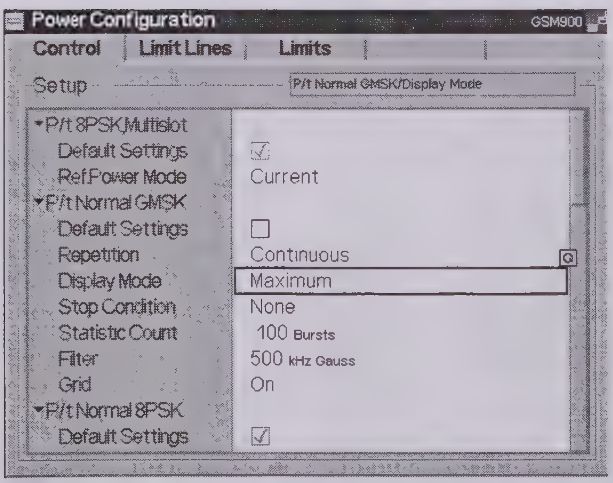
For the next step we'll take advantage of the fact that the configuration menu is accessible from the graphical menu as well.



Step 5



- ➢ Press the *Power/t Norm. GMSK* softkey twice to reopen the *Power Configuration* menu.



Setup P/t Normal GMSK/Display Mode

▾P/t 8PSK Multislot	
Default Settings	☑
Ref.Power Mode	Current
▾P/t Normal GMSK	
Default Settings	☐
Repetition	Continuous
Display Mode	Maximum
Stop Condition	None
Statistic Count	100 Bursts
Filter	500 kHz Gauss
Grid	On
▾P/t Normal 8PSK	
Default Settings	☑

- ➢ Press *ENTER* or the rotary knob to expand the table.
- ➢ Select *Continuous* from the *Repetition* field to restart the measurement and confirm with *ENTER* or by pressing the rotary knob.
- ➢ From the *Display Mode* field, select *Maximum*.③
- ➢ Press *ESCAPE* or the *P/t Norm. GMSK* softkey again to close the configuration menu.

Instead of the current burst power, the diagram shows the maximum burst power measured at each time. As no stop condition is set, the measurement will be running until it is explicitly terminated.

Additional Information...

... on Step 4

① **Softkeys and hotkeys**

To enlarge the diagram area of the graphical measurement menus the left softkey column is suppressed. The functionality of each softkey on the right side is extended by hotkeys assigned to the softkeys. These hotkeys are displayed across the hotkey bar below the diagram when the softkey is selected.

Some of the softkey/hotkey combinations offer settings that can be also accessed via configuration menus. For example, the *Analyzer Level* settings are equivalent to the settings in the *Input Level* and *Trigger* section in the *Analyzer* tab of the *Connection Control* menu. Identical settings overwrite each other; the last value entered is valid for the whole function group and test mode.

② **Markers**

Markers are a graphical tool used to locate points on a trace and read out their coordinates. A reference marker and two delta markers may be defined in the *Power* menu.

The reference marker R measures the absolute level of the trace, the delta markers 1 and 2 measure the absolute level or (if set to relative) the distance between their position and the reference marker.

... on Step 5

③ **Display mode**

If the measurement extends over several bursts the CMU calculates four different traces one of which can be selected in the *Display Mode* field. The purpose of the four traces is to give an overview of the range and arithmetic mean of the levels detected at any point on the time axis. The following traces can be displayed:

Current	Current burst level
Maximum	Maximum of all burst levels measured
Minimum	Minimum of all burst levels measured
Average	Weighted average of all burst levels measured, see averaging prescription in chapter 3.

The *Statistic Count* input field defines how many evaluation periods form a statistics cycle. For *GSMxxx-MS Non Signalling* measurements an evaluation period is equal to the propagation time of a normal burst (this definition holds even if a continuous carrier signal is transmitted). In our example the statistics cycle comprises 100 bursts (default value).

Alternative Settings and Measurements

☞ chapter 4, p. 4.9 ff.

The *Analyzer Level* softkey configures the input level and external attenuation as well as the trigger settings.

The *Analyzer Settings* softkey determines which kind of RF signal can be analyzed.

The *Generator Settings* softkey determines the RF signal generated.

The *Marker/Display* softkey sets markers and D-lines and determines the display area.

☞ chapter 4, p. 4.9 ff.

In addition to markers, a D-line can be used to measure a particular level in the diagram.

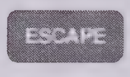
☞ chapter 3.

To refine the statistical evaluation, a suitable combination of the statistic count, repetition mode, stop condition and display mode can be selected.

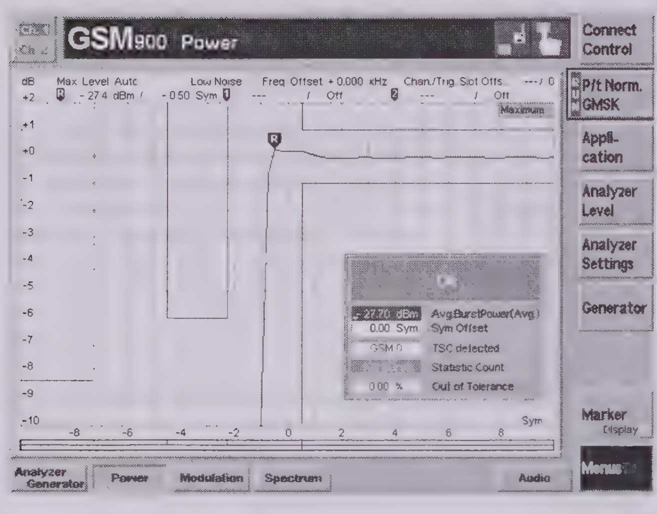
☞ chapter 4, p. 4.27 ff.

In addition to the *Power/t Norm. GMSK* measurement, several test *applications* assessing the behavior of the average burst power over several timeslots *(P/Slot Graph, P/Slot Table)* or frames *(P/Frame)* can be selected (softkey *Application)*.

Step 6



- ➢ Press the ESCAPE key to close the *Power Configuration* menu and return to the main menu.

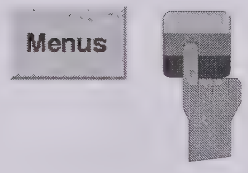


Max Level Autc: - 27.4 dBm / - 0.50 Sym
Low Noise: --- / Off
Freq Offset + 0.000 kHz
Chan./Trig Slot Offs ---/ 0: --- / Off

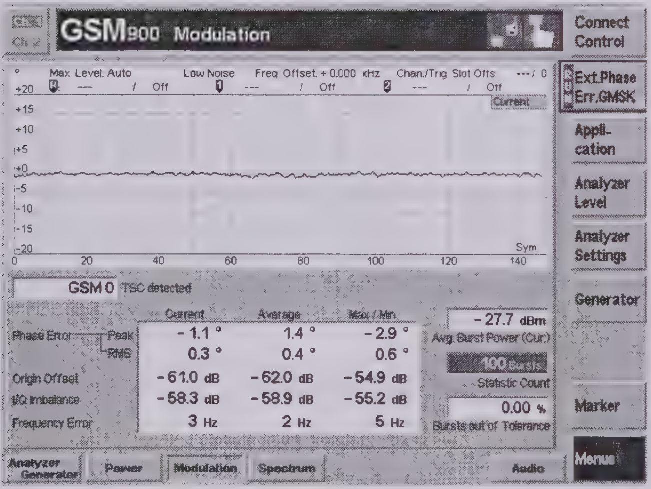
- 27.70 dBm Avg.BurstPower(Avg.)
0.00 Sym Sym Offset
GSM 0 TSC detected
Statistic Count
0.00 % Out of Tolerance

The trace is now continuously measured and updated in the display. With the display mode *Maximum,* which is indicated in the upper right corner of the diagram, trace values will be replaced only if a current measured value at a particular test point exceeds all values measured before at the same test point.

Step 7



- ➢ Press the *Menus* softkey to display the measurement groups available in the hotkey bar.
- ➢ Press the *Modulation* hotkey to open the *Modulation* menu.



Max Level Auto: --- / Off
Low Noise: --- / Off
Freq Offset + 0.000 kHz
Chan./Trig Slot Offs ---/ 0: --- / Off

GSM 0 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	- 1.1 °	1.4 °	- 2.9 °
	RMS	0.3 °	0.4 °	0.6 °
Origin Offset		- 61.0 dB	- 62.0 dB	- 54.9 dB
I/Q Imbalance		- 58.3 dB	- 58.9 dB	- 55.2 dB
Frequency Error		3 Hz	2 Hz	5 Hz

- 27.7 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
0.00 % Bursts out of Tolerance

The *Modulation* menu displays the results of the phase and frequency error measurement.①

The trace represents the phase error of the current burst as a function of time.②

Below, a table displays the extreme value of the phase error and the RMS phase error, the origin offset, the I/Q imbalance, and the frequency error. ③

The detected training sequence (TSC), average power of the current burst and the statistic count are shown in addition.

Additional Information...

... on Step 7

① **Phase and frequency errors**

GSM equipment can use different modulation schemes; the basic scheme is GMSK modulation, which is a constant-envelope, binary, differential phase-shift keying scheme. It is important that the modulation scheme is adhered to as strictly as possible. GSM specifies a peak phase error of max. 20°, a RMS-weighted phase error of max. 5° and a frequency error of max. 0.05 ppm of the transmit frequency.

The limits may be modified in the *Limits* tab of the *Modulation Configuration* Menu which is opened by pressing the selected *Ext. Phase Err. GMSK* softkey once again. The *Modulation Configuration* menu is analogous to the *Power Configuration* menu explained on the previous pages. According to the requirements of the measurements the two configuration menus differ in two points:

- Phase errors are relevant within the useful part of the burst. Therefore, a fixed upper and lower limit for the phase error is specified. It is not necessary to discriminate between different areas of the burst (see item ② below).
- The absolute value of the phase error is a measure of the quality of modulation, whereas the sign is of secondary interest. This is why the display modes *Minimum* and *Maximum* can not be selected separately, the CMU displays the extreme values instead (display mode *Minimum/Maximum*).

② **Measurement curve**

The diagram in the *Modulation* menu shows the useful part of a normal burst with a length of 148 bits, The time scale of the diagram, ranging from 0 bits to 146¾ bits, is thus shorter than in the *Power/t Norm. GMSK* diagram. The ordinate is symmetric around 0 , ranging from –20 dB to +20 dB.

③ **Statistical quantities**

The table below the phase error diagram gives an overview of the phase error averaged over the current burst *(Phase Error RMS),* the extreme value of the current phase error *(Phase Error Peak),* the current Origin Offset and I/Q Imbalance, the current frequency error, and the statistical distribution of these three quantities. The values in the three columns are calculated as follows:

- The *Current* column contains the frequency error, RMS-averaged phase error and peak *(Max./Min.)* phase error for the current burst.
- The *Average* column contains the three quantities averaged over the last statistics cycle.
- The *Maximum* column contains the extreme values of the three quantities within all bursts measured.

Alternative Settings and Measurements

☞ chapter 4, p. 4.37 ff.

The measurement principle for phase and frequency errors is explained at the beginning of section *Measurement Menu (Modulation – GMSK).*

For configuration settings see section *Measurement Configurations (Modulation Configuration).*

As a second modulation scheme, the CMU supports 8PSK-modulated traffic channels (in the so-called EDGE channels).

☞ chapter 4, p. 4.40 ff.

☞ chapter 3.

In this chapter a comprehensive description of measurement control and on the definition of statistical quantities is given.

☞ chapter 4, p. 4.40 ff.

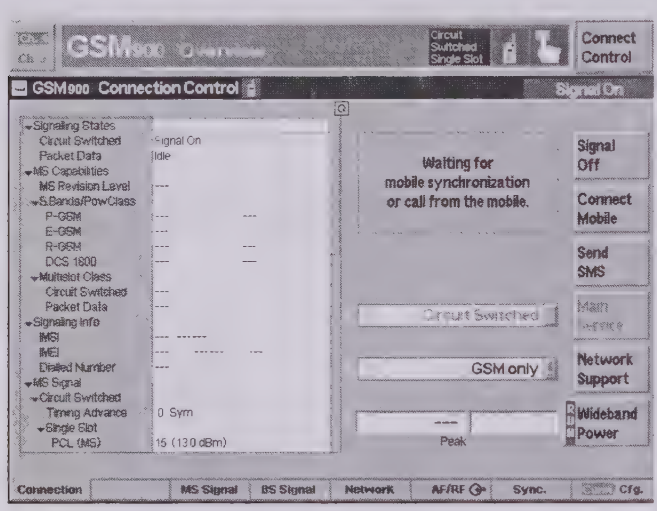
As a last measurement group in *Non Signalling* mode, the *Spectrum* measurement assesses the off-channel power due to the modulation and due to switching.

Signalling Mode

In the *Signalling* mode the CMU first transmits a control channel signal to which the mobile is able to synchronize. A call can then be established from either the CMU or the mobile. The measurement must be synchronized to the signal transmitted by the mobile; an external trigger signal can not be used.

Call Setup and Signalling Parameters

The signalling processes and configurations are controlled via the *Connection Control* popup menu. A control channel signal is switched on and the second of several *Connection* tabs contained in the *Connection Control* popup menu is automatically displayed when the *Connection* test mode is selected (see *Menu Select* menu on page 2.4; for the following examples, *GSM1800-MS Signalling Meas.* with the *Overwiew* menu was selected, and another *RESET* was performed).



Signaling States
Circuit Switched: Signal On
Packet Data: Idle
MS Capabilities
MS Revision Level: ---
S.Bands/PowClass
P-GSM: --- ---
E-GSM: ---
R-GSM: --- ---
DCS 1800: --- ---
Multislot Class
Circuit Switched: ---
Packet Data: ---
Signaling Info
IMSI: --- ------
IMEI: --- ------ ---
Dialed Number: ---
MS Signal
Circuit Switched
Timing Advance: 0 Sym
Single Slot
PCL (MS): 15 (13.0 dBm)

Waiting for mobile synchronization or call from the mobile.

Circuit Switched

GSM only

Peak: ---

⇓

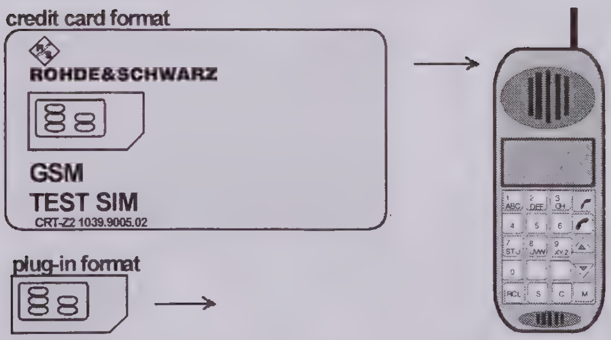
Step 1

The *Connection (Signal On)* tab indicates the current signalling states, the characteristics of the mobile phone and those of the signals generated by the CMU ① and the MS under test.

In addition the network identity and the characteristics of the input and output connectors are shown. ②

The softkeys on the right side of the menu lead to other signalling states. The *Main Service* and *Network Support* softkeys are for switchover to GPRS signalling tests. ③

The *Wideband Power* softkey shows the current status of the wideband peak power measurement and its ratio to the maximum input power *(Max. Level)* set in the *MS Signal* tab menu. At present, the wideband power measurement is switched on, however, no signal is received because no call connection with the mobile phone has been established.



⇓

Step 2

- ➢ Insert a test SIM card of the appropriate size into the phone and switch on.④
- ➢ If requested, enter the PIN number followed by #.
  (PIN No. of Rohde & Schwarz test SIM card: 0000). ⑤
- ➢ Make sure that your mobile is connected to RF 2 (default input/output).

Additional Information...

... on Step 1

① **BS Signal**

The CMU is able to generate two different RF carrier signals (traffic channel and BCCH control channel) which can be configured separately. This allows a complete simulation of what happens in a real GSM network.

Alternative Settings and Measurements

☞ chapter 4, p. 4.141 ff.

The control and traffic channels are configured in the *BS Signal* tab of the *Connection Control* menu. To access this card press the associated hotkey.

② **Network Identity, RF**

The network is identified by the three code numbers MCC (mobile country code), MNC (mobile network code) and NCC (national color code). These codes are transmitted to the mobile station on the control channel. The CMU uses the default settings shown in the diagram on the left side.

Input/output connectors suitable for the type of measurements and signal levels must be chosen – see section *RF connection* on page 2.3. An external input/output attenuation value can be specified in order to compensate for known attenuations of the input/output signal like those caused by cables.

☞ chapter 4, p. 4.147 ff.

The network identity and other parameters characterizing the network are configured in the *Network* tab of the Connection Control menu. To access this card press the associated hotkey (see below).

Input/output connectors and external attenuations are configured in the *RF /*→ tab.

② **GPRS signalling**

With option CMU-K42 the CMU is also able to set up a TBF connection to a GPRS mobile phone and perform transmitter and receiver tests in a GPRS test mode.

☞ chapter 4, p. 4.157 ff.

... on Step 2

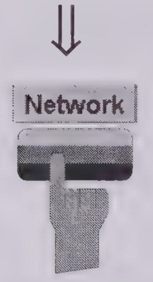
④ **SIM card, test SIM**

Two types of SIM card are specified for use in the GSM system, one the size of a credit card and the considerably smaller plug-in SIM of about 15 x 20 mm. One SIM card must be inserted in the mobile phone in order to set up a call. However, it is also possible to make an emergency call without any card by entering 112.

Most mobile phones require a so-called test SIM card in order to test the sensitivity (bit error rate and related quantities) in a test mode. A test SIM card is available from Rohde & Schwarz with the designation CRT-Z2 (id. no. 1039.9005.02). It features credit card size and can be easily converted to "plug-in" format.

⑤ **Pin number**

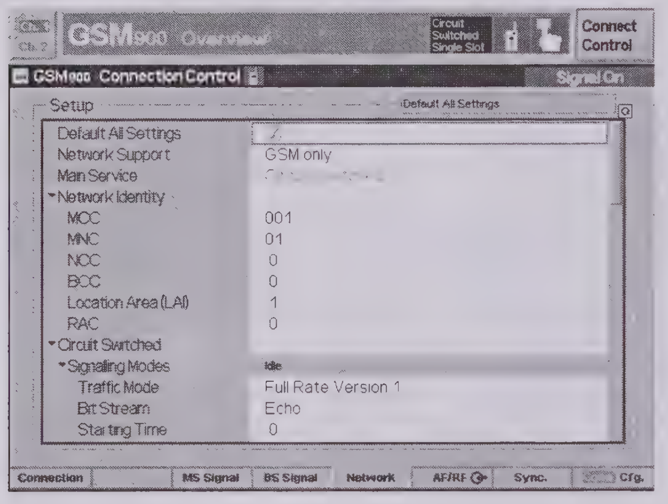
Use care when entering the PIN number as only three false tries are allowed before the card is automatically blocked. It can be unblocked by entering the PUK number which is either known or can be obtained from the company that issued the card. See also the appropriate section in the operating manual of your mobile phone.



Step 3

➢ Press the *Network* hotkey.

The *Network* tab is displayed.

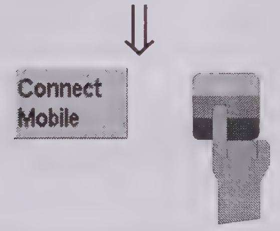


Default All Settings	
Network Support	GSM only
Main Service	
Network Identity	
MCC	001
MNC	01
NCC	0
BCC	0
Location Area (LAI)	1
RAC	0
Circuit Switched	
Signaling Modes	Idle
Traffic Mode	Full Rate Version 1
Bit Stream	Echo
Starting Time	0

The *Network* tab defines a variety of parameters concerning the network and the operating mode of the mobile station.

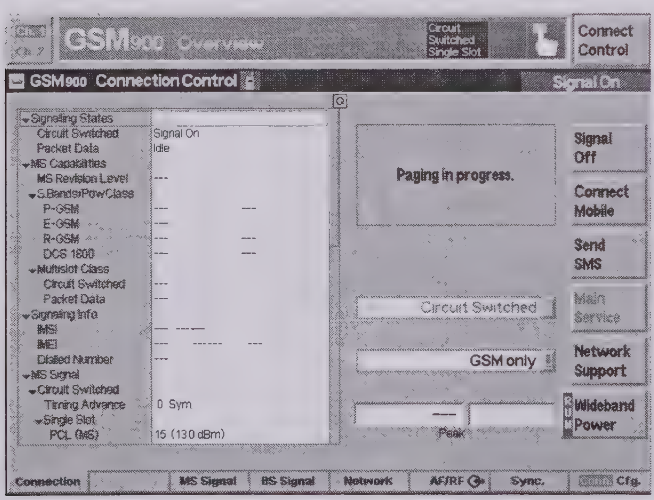
The purpose of these settings is to simulate the operating conditions of a mobile station in the GSM network as realistically as possible. Many of the settings have a direct impact on the speed of the *Signalling* measurements. ③

➢ Press the *Connection* hotkey to return to the *Connection (Signal On)* tab.



Step 4

➢ Press the *Connect Mobile* softkey.



Signaling States		
Circuit Switched	Signal On	
Packet Data	Idle	
MS Capabilities		
MS Revision Level	---	
S.Bands/PowClass		
P-GSM	---	---
E-GSM	---	
R-GSM	---	---
DCS 1800	---	---
Multislot Class		
Circuit Switched	---	
Packet Data	---	
Signaling Info		
IMSI	--- -----	
IMEI	--- ------	---
Dialed Number	---	
MS Signal		
Circuit Switched		
Timing Advance	0 Sym	
Single Slot		
PCL (MS)	15 (13.0 dBm)	

Paging in progress.

Circuit Switched

GSM only

The header message *Paging in progress* is displayed. When the mobile has synchronized to the BS signal and starts ringing, the *Connection (Alerting)* tab is displayed. ①

The *Connection (Alerting)* tab indicates the most important parameters characterizing the mobile phone *(MS Capabilities).* ②

Additional Information...

... on Step 3

③ **Network parameters**

The purpose of network parameter settings in the mobile test can be rather different from the original purpose (in the real GSM network). We illustrate this with two examples:

The *BA list (base station allocation list)* informs the mobile about the channels available in a given area. The mobile uses the BA list to determine to which RF channel it will receive the next handover request. The CMU uses the *BA list* to test a mobile when the synthesizer is jumping continuously from channel to channel and the software has to organize this, to evaluate and report the results.

In the *DTX (discontinuous transmission)* mode the mobile transmits traffic channel frames only when there is voice or data to be transmitted. This mode is used mainly in order to save mobile battery power. In the test mode, a DC current measurement during DTX will provide information about a possible leaking component of the mobile. No continuous *Power* measurements can be done while DTX is enabled.

... on Step 4

① **Location update**

The information transmitted by the CMU on the control channel requests the mobile phone to perform a location update procedure after switching-on. This is similar to a registration procedure in analog and other digital networks and serves to inform the base station that a certain mobile has been switched on now and is available for calls.

② **MS Capabilities**

The *MS Capabilities* list shows the basic properties of the connected mobile station which are transmitted to the CMU.

- The *international mobile subscriber identity (IMSI)* consists of the 3-digit mobile country code, the 2-digit mobile network code and the 10-digit mobile subscriber id. no.
- The *international mobile station equipment identity (IMEI)* consists of the 6-digit type approval code, the 2-digit final assembly code, the 6-digit serial no. and the 1 or 2-digit software version no.

The following hardware-related parameters determine the maximum output power of the mobile station:

- Power class (1 to 5)
- MS revision level (phase I or II)

Alternative Settings and Measurements

☞ chapter 4, p. 4.147 ff.

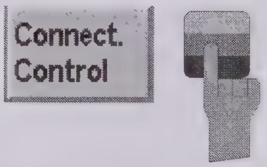
☞ chapter 4, p. 4.147 ff.

The *Location Update* parameter in the *Network* tab determines in which cases a location update is performed.

☞ chapter 4, p. 4.128 ff.

A comprehensive list of mobile station properties is displayed in the *Call Established* signalling state.

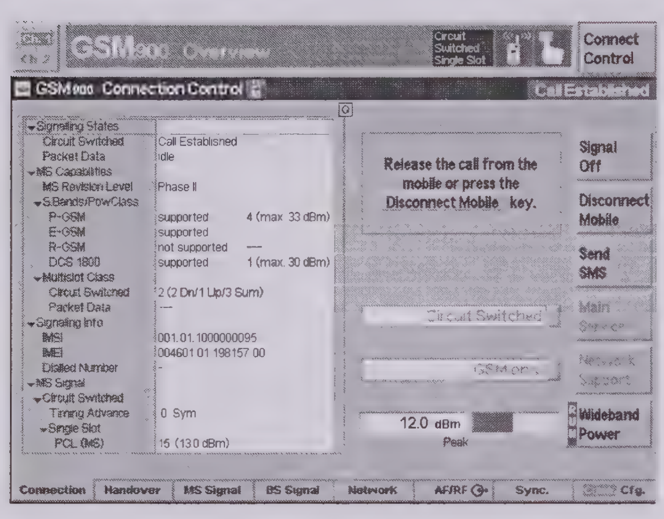
Power classes and GSM revision levels are listed with their maximum output power in section *Limits for the Average Burst Power* in chapter 4.



⇓

Step 5

- ➢ Accept the call at your phone.
- ➢ Press *Connect. Control* to reopen the *Connection Control* menu.



Signaling States		
Circuit Switched	Call Established	
Packet Data	idle	
MS Capabilities		
MS Revision Level	Phase II	
S.Bands/PowClass		
P-GSM	supported	4 (max. 33 dBm)
E-GSM	supported	
R-GSM	not supported	---
DCS 1800	supported	1 (max. 30 dBm)
Multislot Class		
Circuit Switched	2 (2 Dn/1 Up/3 Sum)	
Packet Data	---	
Signaling Info		
IMSI	001.01.1000000095	
IMEI	004601 01 198157 00	
Dialled Number	-	
MS Signal		
Circuit Switched		
Timing Advance	0 Sym	
Single Slot		
PCL (MS)	15 (13.0 dBm)	

Release the call from the mobile or press the Disconnect Mobile key.

12.0 dBm
Peak

The *Connection (Call Established)* presents a comprehensive list of the signalling parameters for the current connection (see *MS Capabilities* on page 2.17).

The power control level of the mobile station ① and the parameters of the traffic channel signals transmitted by the CMU ② can still be configured in the *MS Signal* and *BS Signal* tabs of the *Connection Control*, respectively.

- ➢ Press the *Escape* key to close the *Connection Control* menu and return to the *Overview* menu.

Additional Information...

... on Step 5

① **Power control level (PCL)**

Dynamic power control is used in GSM networks to reduce the output power of the mobile station as far as possible. In practice the base station sets the mobile power on a dimensionless scale of *power control levels (PCL)* ranging from 0 to 31. In GSM900, PCL 0 corresponds to the largest nominal output power (39 dBm), power control levels between 16 and 31 can be set for phase II mobiles only.

In contrast to the PCL the *power class* characterizes the nominal maximum output power of the mobile. Depending on the power class of the mobile the range of possible PCL settings may be restricted.

② **Traffic channel**

The channel number of the BS traffic channel signal is defined according to GSM specifications as explained for the *Non Signalling* mode (downlink, see *Analyzer/Generator menu* on page 2.7).

The traffic channel can be fixed or changed periodically (frequency hopping). Frequency hopping is defined by means of one of the four hopping sequences A, B, C, D.

With the CMU basic unit timeslots 2 to 6 may be selected for the traffic channel because the timeslots 0, 1, and 7 are occupied by the BCCH and for reconfiguring.

Alternative Settings and Measurements

☞ chapter 4, p. 4.103 ff.

PCL levels and power classes are listed in section *Limits for the Average Burst Power* in chapter 4.

☞ chapter 4, p. 4.141 ff.

Besides the four GSM standard hopping sequences A to D arbitrary sequences consisting of up to 64 channel numbers may be defined and used.

Out-of-tolerance power measurements

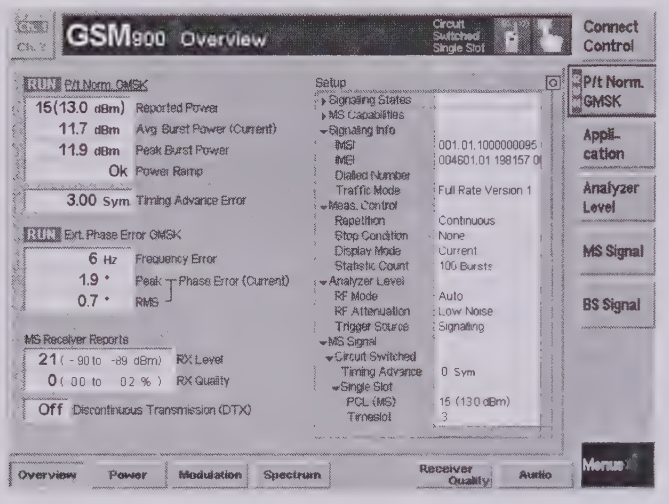
If a power measurement is out of tolerance, please ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As some GSM power levels must be within ±2 dB of the nominal value given in the specifications, even a small attenuation can result in an out-of-tolerance measurement.

External attenuation values for each input/output may be entered in the *RF* ↔ tab of the *Connect. Control* menu

The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by GSM networks.

Receiver Reports and Power Measurements

Besides the signalling parameters discussed above the receiver reports of the mobile station are transmitted to the CMU. Power and modulation measurements can be performed as in the *Non Signalling* mode.



RUN P/t Norm. GMSK
15(13.0 dBm) Reported Power
11.7 dBm Avg Burst Power (Current)
11.9 dBm Peak Burst Power
Ok Power Ramp
3.00 Sym Timing Advance Error

RUN Ext. Phase Error GMSK
6 Hz Frequency Error
1.9 ° Peak
0.7 ° RMS
Phase Error (Current)

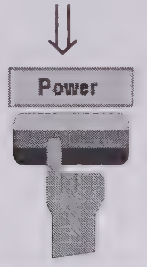
MS Receiver Reports
21 (-90 to -89 dBm) RX Level
0 (0.0 to 0.2 %) RX Quality
Off Discontinuous Transmission (DTX)

Setup
- Signaling States
- MS Capabilities
- Signaling Info
  - IMSI 001.01.1000000095
  - IMEI 004601.01 198157 0
  - Dialled Number
  - Traffic Mode Full Rate Version 1
- Meas. Control
  - Repetition Continuous
  - Stop Condition None
  - Display Mode Current
  - Statistic Count 100 Bursts
- Analyzer Level
  - RF Mode Auto
  - RF Attenuation Low Noise
  - Trigger Source Signalling
- MS Signal
  - Circuit Switched
    - Timing Advance 0 Sym
    - Single Slot
      - PCL (MS) 15 (13.0 dBm)
      - Timeslot 3

Step 1

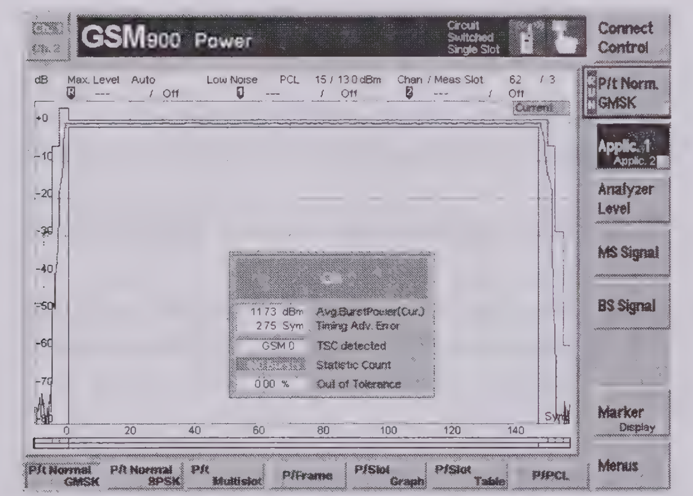
The *Overview* menu indicates the most important settings in the function group *GSM900-MS Signalling* and the main results of the *Power* and *Modulation* measurements (output fields *Ext. Phase Err. GMSK).* Moreover the receiver reports of the mobile station are displayed. ①

Power and *Modulation* measurements can be performed in close analogy to the measurement of GSM signals in the *Non Signalling* mode. The differences between the two modes are related to the settings which can be made at the mobile station.



Step 2

- ➢ Press the *Power* hotkey to switch over to the graphical menu *Power.*



Max. Level Auto / Off
Low Noise --- / Off
PCL 15 / 13.0 dBm
Chan / Meas Slot 62 / 3 --- / Off

11.73 dBm Avg.BurstPower(Cur.)
2.75 Sym Timing Adv. Error
GSM 0 TSC detected
Statistic Count
0.00 % Out of Tolerance

The *Power* menu shows the power of the current burst as a function of time. Like in the *Non Signalling* mode the menu contains an *Application (Applic. 1 or 2)* sotkey.

- ➢ Press the *Applic. 1* softkey to change the hotkeys displayed below the diagram. ②
- ➢ Press the *P/PCL* hotkey to measure the average burst power as a function of the mobile's power control level.
- ➢ Press the *MS Signal* softkey to check the PCL *(PCL* hotkey) and traffic channel number *(Channel* hotkey) set. ③

Step 3

- ➢ Press the *Menus* softkey and the *Receiver Quality* hotkey to switch over to the *Receiver Quality* menu.

Additional Information...

... on Step 1

① **MS Receiver Reports**

GSM mobile phones continuously measure the signal strength and quality of several nearby base stations. The measured values for the active base station (serving cell BTS) are regularly sent to the CMU in the so-called measurement reports.

The received signal input level (RX Level) is expressed in terms of dimensionless power levels ranging from 0 to 63. These levels depend linearly on the absolute signal levels measured in dBm. A high power level implies a high received signal input level.

The received signal quality (RX Quality) is expressed in terms of dimensionless quality levels (actually "error levels") ranging from 0 to 7. The quality levels depend linearly on the logarithm of the bit error rate. A high quality level implies a high bit error rate and thus a poor received signal quality.

... on Step 2

② **P/PCL Measurement**

The *P/PCL* measurement forms the second application in the measurement group *Power*. In this application, the average burst power of the mobile can be measured over the whole range of power control levels and for up to three different channels at once. The PCLs and channels to be measured can be selected; the total measurement time is below 3 s.

③ **PCL/Channel and Trigger**

The PCL set for the mobile station and the traffic channel number can be checked and modified, if required, in the *Power* menu. This is in contrast to the *Non Signalling* mode where no settings concerning the device under test can be made.

Finally the two modes differ in the trigger modes available: In the *Non Signalling* mode an external trigger signal may be used whereas in the *Signalling* mode the measurements must be triggered by the input signal *(Free Run, RF Power, IF Power* mode) or by the CMU's signalling unit *(Signalling* trigger).

Alternative Settings and Measurements

☞ chapter 4, p. 4.118 ff.

The exact definition of RX Level and RX Quality is given in section *Panel MS Rcv. Reports – Received Results of the Mobile Phone.*

The dependence of RX Level and RX Quality on the CMU's output level can be quickly checked by varying the *TCH Level* in the used timeslot.

Different TCH levels can be set in the used timeslot and in the unused timeslots. This is useful for some tests specified by GSM.

☞ chapter 4, p. 4.88 ff.

The different „applications" *Power/t Norm. GMSK, P/PCL* etc. split up the measurement group *Power* in several related subgroups.

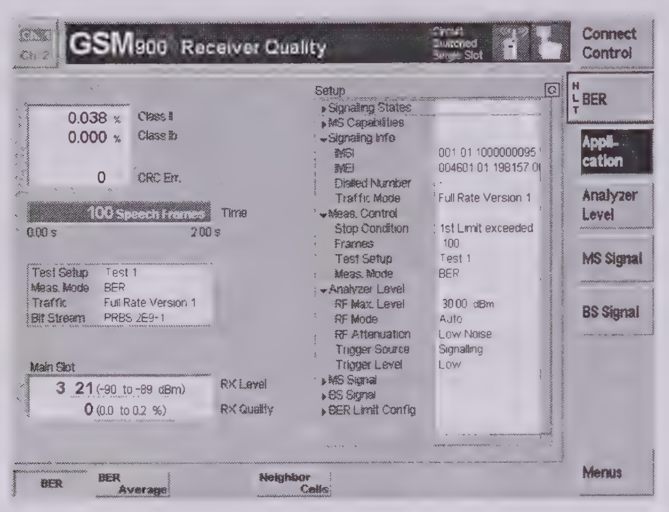
For a general discussion of measurement control and applications see chapters 3 and 5.

☞ chapter 4, p. 4.88 ff.

The frame trigger signal *(Signalling* trigger mode) is also fed to pin 2 of the AUX 3 connector where it can be tapped off to synchronize external devices to the CMU's TDMA timing.

Receiver Quality Measurements

Receiver Quality measurements evaluate parameters which characterize the quality of transmission on the complete signal path between CMU and mobile station. To this purpose the bits sent to the mobile station are looped back and retransmitted. The CMU compares the bits received with those sent and can thus calculate the percentage of faulty bits. Most but not all mobiles require a test SIM card to enter the loop-back mode (see *SIM card, test SIM* on page 2.15).



0.038 % Class II
0.000 % Class Ib
0 CRC Err.
100 Speech Frames Time
0.00 s 2.00 s

Test Setup Test 1
Meas. Mode BER
Traffic Full Rate Version 1
Bit Stream PRBS 2E9-1

Main Slot
3 21 (-90 to -89 dBm) RX Level
0 (0.0 to 0.2 %) RX Quality

Setup
- Signaling States
- MS Capabilities
- Signaling Info
  - IMSI 001 01 1000000095
  - IMEI 004601 01 198157 0
  - Dialled Number
  - Traffic Mode Full Rate Version 1
- Meas. Control
  - Stop Condition 1st Limit exceeded
  - Frames 100
  - Test Setup Test 1
  - Meas. Mode BER
- Analyzer Level
  - RF Max. Level 30.00 dBm
  - RF Mode Auto
  - RF Attenuation Low Noise
  - Trigger Source Signalling
  - Trigger Level Low
- MS Signal
- BS Signal
- BER Limit Config

Step 1

The *Receiver Quality* menu controls the receiver quality tests and displays the measurement results together with the *RX Level* and *RX Quality* of the serving cell. This facilitates a comparison between the results reported by the mobile (RX Quality) and the sensitivity test results.

➢ Press the *Application* softkey to display all applications of the *Receiver Quality* measurement group. Select *BER*. ①

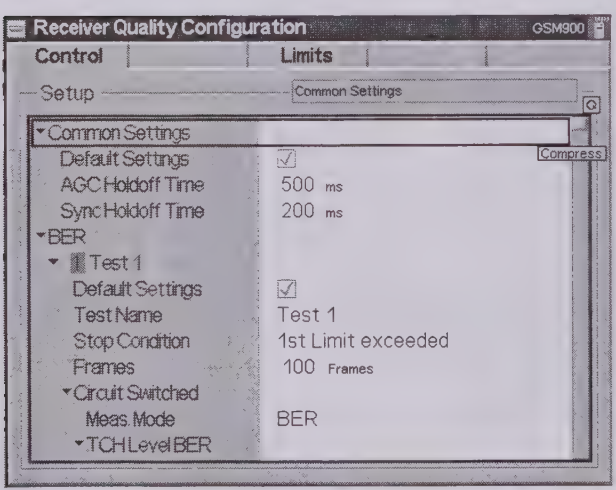
➢ Press the *BER – Meas. Mode* hotkey and select *Burst by Burst*. ②

⇓

Step 2

➢ Press the selected *BER* softkey again.

The *Receiver Quality Configuration* menu is opened.



Setup Common Settings
- Common Settings
  - Default Settings ☑
  - AGC Holdoff Time 500 ms
  - Sync Holdoff Time 200 ms
- BER
  - Test 1
    - Default Settings ☑
    - Test Name Test 1
    - Stop Condition 1st Limit exceeded
    - Frames 100 Frames
    - Circuit Switched
      - Meas. Mode BER
      - TCH Level BER

The *Control* tab contains the parameters configuring the *Receiver Quality* measurement. Most parameters are equal or analogous to the ones used in *Power* or *Modulation* measurements. Major differences occur in the measurement modes available (*Control* tab, ②) and in the definition of the statistics count. ③

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Applications**

Within the *Receiver Quality* measurement group, the repetition modes *BER* (single shot bit error rate tests) and *BER Average* (continuous bit error rate tests) are treated as different applications. For single shot measurements, up to ten different test setups with independent parameters can be configured (see *Control* tab in the *Receiver Quality Configuration* menu).

☞ chapter 4, p. 4.114 ff.

For a general discussion of measurement control and applications see chapters 3 and 5.

② **Measurement Mode**

A number of different quantities characterizing the quality of transmission are defined:

- Bit error rate (for class II and class Ib bits)
- Residual bit error rate (for class II and class Ib bits)
- Frame erasure rate

The type of quantities measured depends on the measurement mode *(BER, RBER/FER*, or *Burst by Burst).* In the *Burst by Burst* mode which is specified for GSM phase II and phase II+ mobiles, only bits without error protection are transmitted. This enhances the speed of the bit error rate test (fast BER test).

☞ chapter 4, p. 4.114 ff.

The bit classes and measured quantities are explained at the beginning of section *Measurement Menu Receiver Quality*.

... on Step 2

③ **Statistics**

In the framework of sensitivity tests the basic evaluation period is equal to the frames used by the speech coder and consisting of 260 bits. Bursts and TDMA frames are irrelevant.

A statistics cycle thus consists of a definite number of frames.

☞ chapter 3 and 4.

Failed Receiver Quality Test

If a BER test fails check the following:

1. Ensure that the attenuation of any antenna coupler and/or cables used is being taken into account by the CMU. During the test the mobile receiver is being tested with very low RF signal levels, and even a small attenuation can cause the CMU to show a fail indication.
2. An external signal from a real network may interfere with the signal sent from the CMU to the mobile, in particular during BER tests where the output level of the CMU is reduced to as low as -104 dBm. The BER test should ideally be performed in a shielded room, however, if this is not possible, the channel(s) used for the test should be changed. If different results are obtained on neighboring channels, the problem is likely to be due to external interferences.

ROHDE&SCHWARZ
Test and Measurement
Division

Operating Manual

Software Options:

GSM400/850/900/1800/1900-MS for CMU-B21

R&S CMU-K20/-K21/-K22/-K23/-K24

1115.5900.02/6007.02/6107.02/6207.02/6307.02

Including GPRS Software Extension

for all GSM Software Packages

R&S CMU-K42

1115.4691.02

Printed in the Federal
Republic of Germany

Dear Customer,

throughout this manual, CMU-K20 to CMU-K24 and CMU-K42 is generally used as an abbreviation for software options R&S CMU-K20 to R&S CMU-K24 and R&S CMU-K42. The Universal Radio Communication Tester R&S CMU 200 is abbreviated as CMU200.

Tabbed Divider Overview

Safety Instructions
Certificate of Quality
List of R&S Representatives

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Tabbed Divider

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2	Chapter 2:	Getting Started
3	Chapter 3:	Manual Operation
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DQS REG. NO 1954-04

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Contents of Manuals for Universal Radio Communication Tester CMU

Operating Manual CMU-K20/-K21/-K22/-K23/-K24 (Software Options: GSM400/900/1800/1900/850-MS for CMU-B21)

The present operating manual describes the application of CMU for GSM mobile tests. It gives comprehensive information about the installation of the required software options and about manual and remote control of the instrument. Typical measurement tasks are explained in detail using the functions offered by the graphical user interface and a selection of program examples.

The manual is organized as follows:

Chapter 1	Describes the steps necessary for installing the software and putting the instrument into operation.
Chapter 2	Gives an introduction to the application of the CMU for GSM mobile station tests and presents typical measurement examples.
Chapter 3	Gives an overview of the user interface and describes the concepts of measurement control and instrument configuration.
Chapter 4	Represents the reference chapter providing detailed information on all functions of the user interface and their application.
Chapter 5	Describes the basics of remote control of the instrument for GSM base station tests.
Chapter 6	Lists all remote control commands for GSM mobile station tests. At the end of the chapter the commands are grouped together according to their function (measurement groups or configurations) and sorted in alphabetical order.
Chapter 7	Contains program examples.
Chapter 10	Contains an index for the operating manual.

Operating Manual CMU200/CMU300

In the operating manual for CMU basic unit you will find information about the technical specifications of the CMU, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control. Typical measurement tasks are explained in detail using the functions of the user interface and program examples.

In addition, the operating manual lists the most important warnings and error messages which may be output by the instrument.

Service Manual Instrument

The service manual instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of CMU by exchanging modules.

Service Manual Modules

The service manual modules is not delivered with the instrument but may be obtained from your R&S service department using the order number 1100.4903.91.

Service manual modules contains information about the individual modules of CMU. This comprises the test and adjustment of the modules, fault detection within the modules and the interface description.

Further Operating Manuals for Network Tests

The operating manuals listed in the following table describe the test of mobile phones supporting different standards by means of the CMU and the appropriate software and hardware options. The network test operating manuals are organized like the present GSM-MS operating manual.

		For Options		
Manual	**Order Number**	**Type**	**Description**	**Stock No.**
Operating Manual CMU-K27/-K28	1115.6688.12	CMU-K27 CMU-K28	TDMA800-MS for CMU-B21 TDMA1900-MS for CMU-B21	1115.6607.02 1115.6707.02
Operating Manual CMU-K29	1115.6888.12	CMU-K29	AMPS-MS for CMU-B21	1115.6807.02
Operating Manual CMU-K30/-K31/-K32/-K33/-K34	1115.4185.12	CMU-K30 CMU-K31 CMU-K32 CMU-K33 CMU-K34 CMU-K39 CMU-K41	GSM400-BS for CMU-B21 GSM900-BS for CMU-B21 GSM1800-BS for CMU-B21 GSM1900-BS for CMU-B21 GSM850-BS for CMU-B21 MOC/MTC EDGE for CMU-K30/31/32/33	1115.4004.02 1115.4104.02 1115.4204.02 1115.4304.02 1115.4404.02 1115.4791.02 1115.4604.02
Operating Manual CMU-K53	1115.5081.12	CMU-K53	Bluetooth for CMU	1115.5000.02
Operating Manual CMU-K65/-K66	1115.4962.12	CMU-K65 CMU-K66	WCDMA UE TX Test (3GPP/FDD) WCDMA (3GPP/FDD, DL) Generator	1115.4962.12 1115.5100.02
Operating Manual CMU-K81/-K82	1115.5581.12	CMU-K81 CMU-K82	CDMA800-MS (IS95) for CMU-B81 CDMA1900-MS (IS95) for CMU-B81	1115.5500.02 1115.5600.02
Operating Manual CMU-K83/-K84/-K85/-K87	1150.0382.12	CMU-K83 CMU-K84 CMU-K85 CMU-K86	CDMA2000-MS (450 MHz band) CDMA2000-MS (cellular band) CDMA2000-MS (PCS band) CDMA2000-MS (IMT-2000 band)	1150.3500.02 1150.3600.02 1150.3700.02 1150.3800.02

The GSM base station tests described in operating manual CMU-K30/-K31/-K32 require a CMU300 (Universal Radio Communication Tester for BTS). All other radio communication equipment is tested with model CMU200.

What's new in this Revision...

This operating manual describes version V3.05 of the GSM-MS firmware package. Compared to previous versions, this new firmware provides numerous extensions and improvements. The new features described in this manual are listed below.

New Features	**Description**	**Refer to...**
GSM850	New GSM band available, option CMU-K24.	Chapter 4, chapter 6
Analyzer/ Generator	Improved layout with different applications and softkey/hotkey control	Chapter 4, GSM Module Tests (Non Signallig) → Analyzer/Generator
Multislot measurements	New application *P/t Multislot* to measure the burst power vs. time in up to 4 consecutive bursts. TX and RX measurements on mobile stations supporting multislot operation can be performed in Non Signalling and Non Signalling mode. In Signalling mode, the CMU is capable of configuring multislot downlink and uplink TCH signals.	Chapter 4, GSM Module Tests (Non Signallig) → Power Measurements GSM Mobile Tests (Signallig) → Connection Control
P/Slot Table	All integer slot numbers n = 1 to 512 possible	Chapter 4, GSM Module Tests (Non Signallig) → Power Measurements
Overview	Improved layout with different applications and softkey/hotkey control	Chapter 4, GSM Mobile Tests (Signallig) → Overview
8PSK measurements	All measurements on 8PSK-modulated channels available in Signalling mode	Chapter 4, GSM Mobile Tests (Signallig)
Bit Stream	Independent *Bit Stream* setting for Receiver Quality measurements	Chapter 4, GSM Mobile Tests (Signallig) → Receiver Quality Measurements
DBLER	Data block error rate can be measured for circuit-switched and packet-switched data channels.	Chapter 4, GSM Mobile Tests (Signallig) → Receiver Quality Measurements
BCCH or TCH	The downlink BCCH can be switched off after establishing the connection. This implies that all downlink timeslots are available for traffic channels.	Chapter 4, GSM Mobile Tests (Signallig) → Connection Control, BS Signal
Frame trigger	Frame trigger (timeslot 0 of each MS TDMA frame except the idle frame) available in Signalling mode and fed to pin 2 of AUX 3 connector.	Chapter 4, GSM Mobile Tests (Signallig) → Connection Control, MS Signal
`NPOWer`	New narrow-band power measurement in remote control (Non Signalling and Signalling test mode).	Chapter 6, → NPOWer
`[:CSWitched]`	Many *Connection Control* remote commands extended with optional keyword for circuit-switched channels. Improved remote control concept for Connection Control commands (`SIGNalling, MSSignal, BSSignal, NETWork`).	Chapter 6, GSM Mobile Tests (Signalling) → Connection Control
`ACLass`	The remote control command `CONFigure:NETWork:SYSTem:ACLass` prevents mobiles with definite access classes from attempting a cell access	Chapter 6, GSM Mobile Tests (Signalling) → Connection Control, `NETWork`

New Features	Description	Refer to...
Local → Remote without call dropping	The remote control command `SYST:GTRM:COMP OFF` causes the signalling state to be maintained upon a local to remote transition	Chapter 6 of CMU manual Base system commands
Option CMU-K42, GPRS Signalling	The CMU is able to set up a TBF connection and perform TX and RX measurements in packet-switched GPRS data channels. In the context of the *Receiver Quality* measurements, the DBLER and USFBLER for packet data channels can be evaluated.	Chapter 4, Options and Extensions → GPRS Signalling

Frequently Used Abbreviations

AB	*Access Burst*
Abs.	*Absolute*
AGC	*Automatic Gain Control*
AOC	*Advice of Charge*
Atten.	*Attenuation*
BA	*BCCH Allocation*
Bandw.	*Bandwidth*
BCC	*Base Transceiver Station Color Code*
BCCH	*Broadcast Control Channel*
BER	*Bit Error Rate*
BS	*Base (Transceiver) Station*
BS-AG-BLKS-RES	*Basic Services Access Grant Blocks Reserved*
BS-PA-MFRMS	*Basic Service Paging Blocks Available per Multiframes*
BTS	*Base Transceiver Station*
Chan.	*Channel*
CRC	*Cyclic Redundancy Check*
DBLER	*Data Block Error Rate*
Disp.	*Display*
Err.	*Error*
EVM	*Error Vector Magnitude*
Ext.	*External*
FAC	*Final Assembly Code*
FACCH	*Fast Associated Control Channel*
FER	*Frame Erasure Rate*
Freq.	*Frequency*
GPRS	*General Packet Radio Service*
GSM	*Global System for Mobile Communication, Groupe Spécial Mobile*
IF	*Intermediate Frequency*
IMEI	*International Mobile Equipment Identity*
IMSI	*International Mobile Subscriber Identity*
Lev.	*Level*
Magn.	*Magnitude*
Max./Min.	*Maximum/Minimum*
Max.	*Maximum (e.g. Level)*
MCC	*Mobile Country Code*
MNC	*Mobile Network Code*
MOC	*Mobile Originated Call*
MS	*Mobile Station*
MSIN	*Mobile Subscriber Identity Number*
MTC	*Mobile Terminated Call*
NB	*Normal Burst*
Ovw.	*Overview*
PCL	*Power Control Level*
PCL	*Power Control Level*
PDTCH	*Packet-Switched Data Traffic Channel*
PDU	*Protocol Data Unit*
PRBS	*Pseudo Random Bit Sequence*
PSR	*Pseudo Random*
PTP	*Point to Point (GPRS services)*
RACH	*Random Access Channel*
RBER	*Residual Bit Error Rate*
Rcv.	*Receiver*
Ref.	*Reference*
Rel.	*Relative*
RF	*Radio Frequency*
RMS	*Root Mean Square (averaging)*
SDCCH	*Stand-alone Dedicated Channel*
Seq.	*Sequence*
SMS	*Short Message Service*
SNR	*Serial Number*
SVN	*Software Version Number*
TAC	*Type Approval Code*
TBF	*Temporary Block Flow*
TDMA	*Time Division Multiple Access*
TLLI	*Temporary Link Level Identity*
Trg.	*Trigger*
TSC	*Training Sequence (Code)*
USF	*Update State Flag*
Vect.	*Vector*

The two parameter lines and the info box are identical with the *due to Modulation* menu, see above. Note that, according to GSM specifications, the *Ref. Power* is measured with a filter bandwidth of 300 kHz so that it slightly differs from the average burst power determined in the *Power vs. Time* menu.

Bar graph The bar graph shows the current carrier output power of the mobile station and the measured spectrum due to switching at up to 4 non-equidistant frequencies that are symmetrically distributed around the carrier frequency. The diagram is scaled such that the x-axis indicating the frequency offset from the carrier ranges from –2 MHz to +2 MHz; the y-axis is in absolute power units (dBm). The spectral tolerance mask defined in the *Limit Lines* tab (see p. 4.60 ff.) is indicated in addition. The measurement result at particular frequencies can be retrieved by means of markers. The measurement at every single frequency point can be switched on and off in the Meas X tab (see p. 4.65).

Limit Check The upper limit lines defined in the Limit Lines tab of the configuration menu (see p. 4.60 ff.) yield the red polygonal curve in the diagram. If the limit check fails at a particular test point the corresponding section of the bar across the bottom of the diagram turns red.

Remote control
`READ:ARRay:SPECtrum:SWITching[:GMSK]?`
`FETCh:ARRay:SPECtrum:SWITching[:GMSK]?`
`SAMPle:ARRay:SPECtrum:SWITching[:GMSK]?`

Measurement Configurations (Spectrum)

The popup menu *Spectrum Configuration* contains three tabs which define the parameters of the spectrum measurement including the error tolerances.

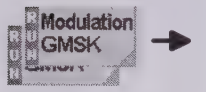
The popup menu *Spectrum Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *due to Modulation* or *due to Switching*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

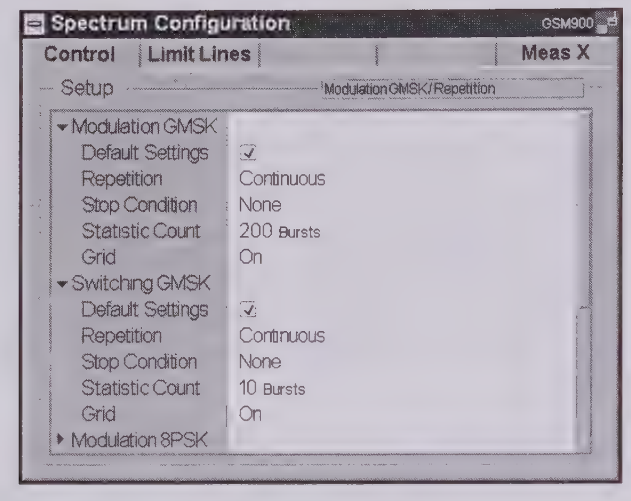
Measurement Control (Spectrum Configuration – Control)

The tab *Control* controls the spectrum measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*)
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*,
- The averaging prescription to obtain the reference power *(Ref. Power Mode*, for *8PSK* measurements only)

Besides, it influences the measurement diagram by adding or removing the *Grid*.





Modulation GMSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Statistic Count 200 Bursts
Grid On
Switching GMSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Statistic Count 10 Bursts
Grid On
Modulation 8PSK

Fig. 4-32 Spectrum Configuration – Control

All settings can be defined separately for the two applications *due to Modulation* and *due to Switching* and for the two modulation schemes *GMSK* and *8MSK*. They comply with those of the menu *Control* in the menu group *Power* (see page 4.27). In the remote-control commands, the keyword `POWer` is to be replaced by `SPECtrum:MODulation` or `SPECtrum:SWITching`.

Tolerance Values (Spectrum Configuration – Limit Lines)

The tab *Limit Lines* defines upper limits for the output spectrum around the RF carrier frequency. All relative limit values are referred to the actual carrier output power of the base station.

a) Spectrum due to Modulation

The limit lines for the *spectrum due to modulation* as specified in GSM 05.05 and GSM 11.10 depend on the GSM band, the frequency, and (for frequencies that differ from the carrier frequency by more than 400 kHz) on the output power of the mobile station. The following values apply up to a frequency offset of 1.8 MHz:

Table 4-1 GSM tolerances for spectrum due to modulation

	GSM400/850/900 Relative power at MS output power		**GSM1800/1900 Relative power at MS output power**	
Frequency offset / [MHz]	**≤ 33 dBm (in dBc)**	**≥ 39 dBm (in dBc)**	**≤ 24 dBm (in dBc)**	**≥ 36 dBm (in dBc)**
0.1	+0.5	+0.5	+0.5	+0.5
0.2	–30	–30	–30	–30
0.25	–33	–33	–33	–33
0.4	–60 (GMSK mod.) –54 (8PSK mod.)	–60	–60 (GMSK mod.) –54/–60 (8PSK mod.)[3]	–60
≥0.6, ≤1.8	–60	–66	–60	–60

---

[3] For equipment supporting 8PSK, the limit of –54 dBc applies to MS output powers up to +30 dBm, –60 dBm to MS output powers above +30 dBm.

In the frequency range above 400 kHz from the carrier and for output powers between 33 dBm and 39 dBm (GSM400/850/900), the limit depends linearly on the output power. The resulting spectral mask for GMSK modulation is shown below (Fig. 4-33).

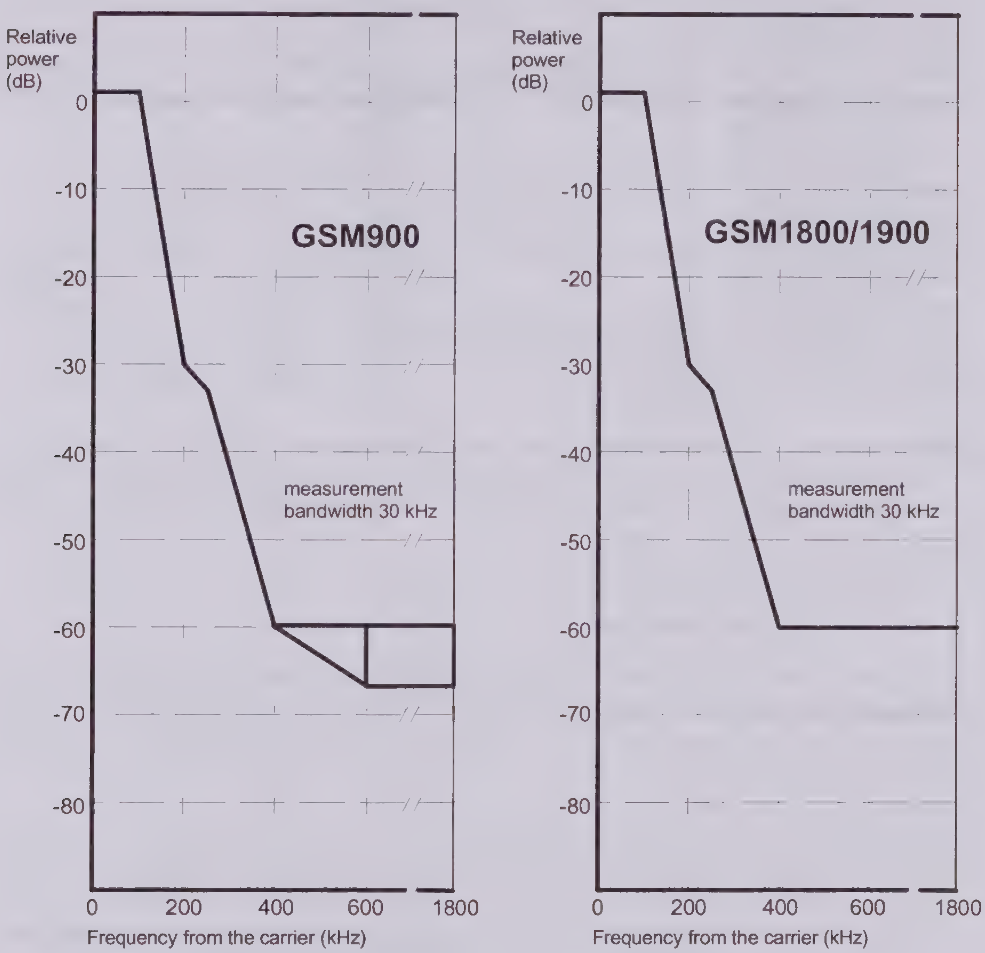
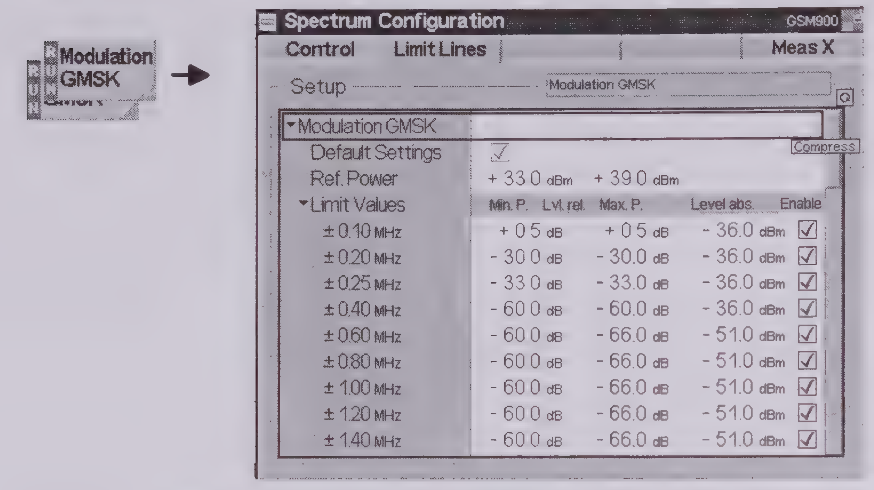


Fig. 4-33 Spectral mask as specified for GSM mobile stations

As an alternative to the relative limit values quoted in Table 4-1, GSM specifies the following absolute limits, again depending on the frequency offset from the carrier and the GSM band. If the relative limits are tighter than the absolute limits, the latter shall be applied.

Table 4-2 GSM tolerances for spectrum due to modulation (absolute)

Frequency offset / [MHz]	**Absolute power, GSM400/850/900**	**Absolute power, GSM1800/1900**
< 0.6	–36 dBm	–36 dBm
≥0.6, <1.8	–51 dBm	–56 dBm
≥1.8	–46 dBm	–51 dBm



Modulation GMSK

Modulation GMSK					
Default Settings	☑				
Ref. Power	+ 33.0 dBm	+ 39.0 dBm			
Limit Values	Min. P. Lvl. rel.	Max. P.		Level abs.	Enable
± 0.10 MHz	+ 0.5 dB	+ 0.5 dB		- 36.0 dBm	☑
± 0.20 MHz	- 30.0 dB	- 30.0 dB		- 36.0 dBm	☑
± 0.25 MHz	- 33.0 dB	- 33.0 dB		- 36.0 dBm	☑
± 0.40 MHz	- 60.0 dB	- 60.0 dB		- 36.0 dBm	☑
± 0.60 MHz	- 60.0 dB	- 66.0 dB		- 51.0 dBm	☑
± 0.80 MHz	- 60.0 dB	- 66.0 dB		- 51.0 dBm	☑
± 1.00 MHz	- 60.0 dB	- 66.0 dB		- 51.0 dBm	☑
± 1.20 MHz	- 60.0 dB	- 66.0 dB		- 51.0 dBm	☑
± 1.40 MHz	- 60.0 dB	- 66.0 dB		- 51.0 dBm	☑

Fig. 4-34 Spectrum Configuration – Limit Lines

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual spectrum types are provided.

Remote control

```
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:DEFault
          ON|OFF etc.
```

Ref. Power The *Ref. Power* line defines the MS carrier output power domain where the limit lines are to be determined by linear interpolation (see Table 4-1). Below *Min. P.*, the lower limit line applies, above *Max. P.*, the upper limit line applies. The *Ref. Power* domain can be modified.

Remote control

```
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE
          :REFPower[:UPPer] <Min_Power>,<Max_Power>
```

Limit Values The *Limit Values* table section defines upper limits for the power at eleven fixed, GSM-specific frequency offsets:

Lvl. rel.	Upper limit for the RF power referred to the MS output power measured in 30 kHz on the carrier. The two values are valid for output powers below the *Ref. Power* domain *(Min. P.)* and for output powers above the *Ref. Power* domain *(Max. P.)*. Inside the *Ref. Power* domain, *Lvl. rel.* is determined by linear interpolation.
Level abs.	Alternative absolute power limits (see Table 4-2), applied if the relative limits *Lvl. rel.* are tighter.
Enable	Switches the limit check at the frequency on and off.

Remote control

```
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE
    [:ASYMmetrical]:UPPer<nr> <RelLow>,<RelUpp>,<Abs>,<Enable>
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:MODE[:UPPer]
    ON|OFF etc.
```

b) Spectrum due to Switching

The limit lines for the *spectrum due to switching* as specified in GSM 05.05 and GSM 11.10 cover offset frequencies between 0.4 and 1.8 MHz. They are equal for all three GSM bands but depend on the output power of the mobile station. The measurement of the spectrum due to switching is complicated by the fact that at high power levels, the modulation spectrum is being measured using a peak hold measurement. The tolerances in the following table allow for the additional effects due to the modulation spectrum:

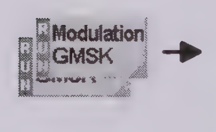
Table 4-3 GSM tolerances for spectrum due to switching plus modulation effects:

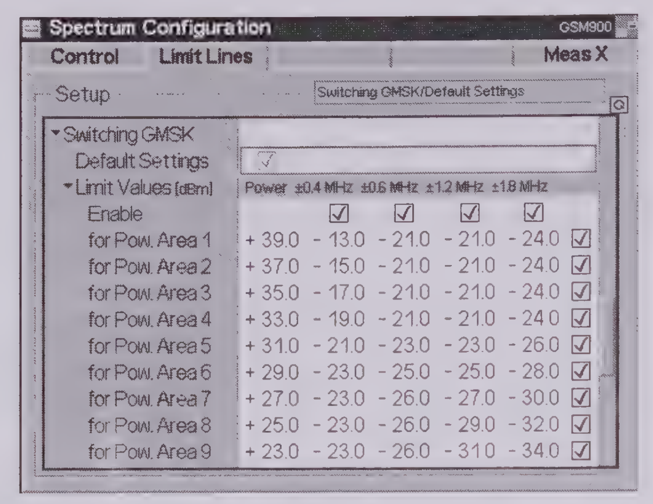
GSM400/ GSM850/ GSM900	**Maximum MS level measured (peak hold) / [dBc] at frequency offset**			
MS power / [dBm]	**0.4 MHz**	**0.6 MHz**	**1.2 MHz**	**1.8 MHz**
≥39	–13	–21	–21	–24
+37	–15	–21	–21	–24
+35	–17	–21	–21	–24
+33	–19	–21	–21	–24
+31	–21	–23	–23	–26
+29	–23	–25	–25	–28
+27	–23	–26	–27	–30
+25	–23	–26	–29	–32
+23	–23	–26	–31	–34
≤21	–23	–26	–32	–36

GSM1800	**Maximum MS level measured (peak hold) / [dBc] at frequency offset**			
MS power / [dBm]	**0.4 MHz**	**0.6 MHz**	**1.2 MHz**	**1.8 MHz**
≥36	–16	–21	–21	–24
+34	–18	–21	–21	–24
+32	–20	–22	–22	–25
+30	–22	–24	–24	–27
+28	–23	–25	–26	–29
+26	–23	–26	–28	–31
+24	–23	–26	–30	–33
+22	–23	–26	–31	–35
≤20	–23	–26	–32	–36
–	–	–	–	–

GSM1900	**Maximum MS level measured (peak hold) / [dBc] at frequency offset**			
MS power / [dBm]	**0.4 MHz**	**0.6 MHz**	**1.2 MHz**	**1.8 MHz**
≥33	–19	–22	–22	–25
+32	–20	–22	–22	–25
+30	–22	–24	–24	–27
+28	–23	–25	–26	–29
+26	–23	–26	–28	–31
+24	–23	–26	–30	–33
+22	–23	–26	–31	–35
≤20	–23	–26	–32	–36

The GSM limit specifications are equal for GMSK and 8PSK modulation, however, the limits can be chosen independently on the CMU.





▾ Switching GMSK

Default Settings ☑

▾ Limit Values [dBm]	Power	±0.4 MHz	±0.6 MHz	±1.2 MHz	±1.8 MHz	
Enable		☑	☑	☑	☑	
for Pow. Area 1	+ 39.0	- 13.0	- 21.0	- 21.0	- 24.0	☑
for Pow. Area 2	+ 37.0	- 15.0	- 21.0	- 21.0	- 24.0	☑
for Pow. Area 3	+ 35.0	- 17.0	- 21.0	- 21.0	- 24.0	☑
for Pow. Area 4	+ 33.0	- 19.0	- 21.0	- 21.0	- 24.0	☑
for Pow. Area 5	+ 31.0	- 21.0	- 23.0	- 23.0	- 26.0	☑
for Pow. Area 6	+ 29.0	- 23.0	- 25.0	- 25.0	- 28.0	☑
for Pow. Area 7	+ 27.0	- 23.0	- 26.0	- 27.0	- 30.0	☑
for Pow. Area 8	+ 25.0	- 23.0	- 26.0	- 29.0	- 32.0	☑
for Pow. Area 9	+ 23.0	- 23.0	- 26.0	- 31.0	- 34.0	☑

Fig. 4-35 Spectrum Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual spectrum types are provided.

Remote control

```
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:DEFault ON|OFF
```

Limit Values

The *Limit Values* table section defines upper limits for the absolute output power of the mobile station, measured at zero frequency span and with a filter bandwidth of 30 kHz.

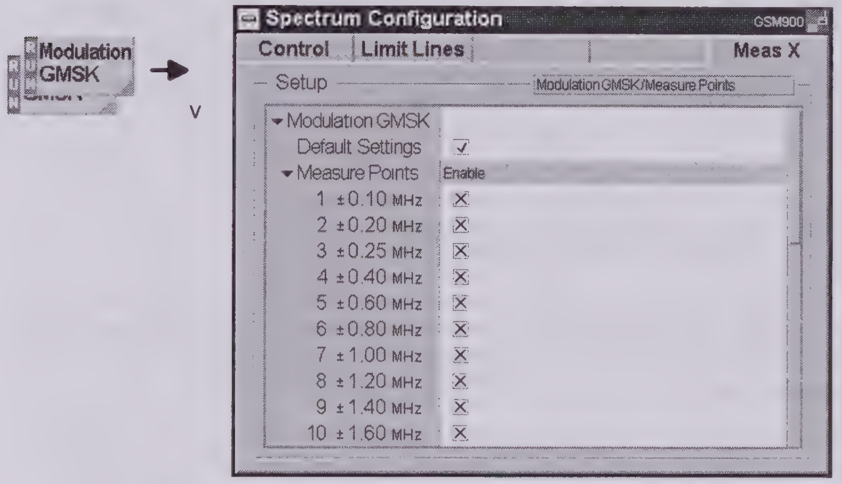
Enable	Switches the limit check at the frequency or power level on and off
Power Lvl.	User-defined MS output power level (not necessarily identical with the GSM power control levels). The CMU offers considerable flexibility with regard to the limit line definition: They are specified at four fixed, GSM-specific frequency offsets and up to 10 arbitrary MS power levels (see Table 4-3). For measured MS powers between the power levels, the limits are determined by linear interpolation.

Remote control

```
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE
      [:ASYMmetrical]:UPPer<nr>
      <PowLvl>,<Value1>,<Value2>,<Value3>,<Value4>,<Enable>
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:MODE[:UPPer]
      ON|OFF
```

Selection of Measurement Points (Spectrum Configuration – Meas X)

The tab *Meas X* defines at which frequencies a *Spectrum* measurement is performed.



Modulation GMSK	
Default Settings	✓
Measure Points	Enable
1 ±0.10 MHz	☒
2 ±0.20 MHz	☒
3 ±0.25 MHz	☒
4 ±0.40 MHz	☒
5 ±0.60 MHz	☒
6 ±0.80 MHz	☒
7 ±1.00 MHz	☒
8 ±1.20 MHz	☒
9 ±1.40 MHz	☒
10 ±1.60 MHz	☒

Fig. 4-36 Spectrum Configuration – Meas X

All settings can be defined separately for the two applications *due to Modulation* and *due to Switching*.

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Meas X* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual spectrum types are provided.

Remote control

```
CONFigure:SPECtrum:MODulation:CONTrol:DEFault ON|OFF
CONFigure:SPECtrum:SWITching:CONTrol:DEFault ON|OFF
```

Measure Points The *Measure Points* table section enables (*Enable* box checked) or disables the spectrum measurement at individual frequency points. All frequencies listed in Table 4-1 (spectrum due to modulation) and Table 4-3 (spectrum due to switching) can be selected. A reduction of the measurement points enhances the measurement speed.

Remote control

```
CONFigure:SPECtrum:MODulation[:GMSK]
           :CONTrol:MPOint<nr>:ENABle ON|OFF etc.
```

Connection Control

The popup menu *Connection Control* consists of four tabs which configure the inputs and outputs of the CMU and the respective signals in the function group *GSM400/850/900/1800/1900-MS Non Signalling.*

The menu group is activated via the softkey *Connect. Control* to the right of the header of each measurement menu. The individual tabs *(Analyzer, Generator, RF* and *Sync.)* can be accessed via the hotkey bar at the lower edge of the screen.

RF Analyzer Settings (Connection Control – Analyzer)

The *Analyzer* tab determines the maximum input level *(Max. Level)* of the RF analyzer, defines the frequency *(RF Channel, Frequency Offset)* and the *Training Sequence* of the analyzed RF input signal and configures the RF input path as well as the trigger settings. Besides it controls the wideband peak power measurement *(Power)* and indicates the result.

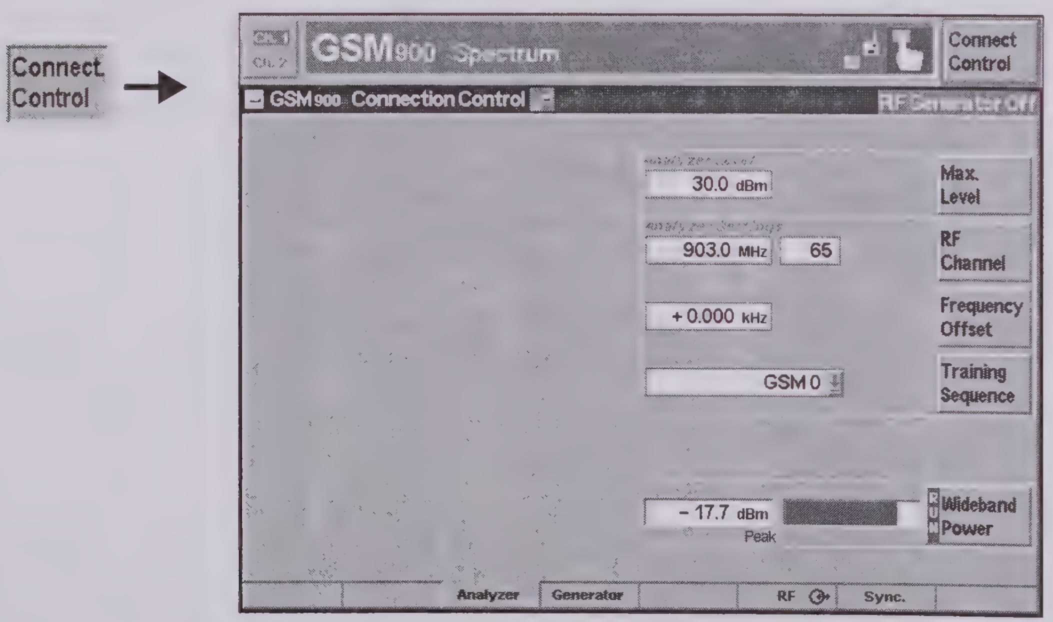
The CMU provides a softkey-oriented version of the *Analyzer* tab and a table-oriented version with extended functionality. The *Analyzer* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-Oriented Version

The softkey-oriented version of the *Analyzer* tab determines

- The maximum input level *(Max. Level)*
- The frequency *(RF Channel, Frequency Offset)* and the *Training Sequence* of the analyzed RF input signal.

Besides it controls the wideband peak power measurement *(Power)* and indicates the result. All setting values of this menu are also displayed in the main menu *Analyzer/Generator* (see page 4.2).



Max. Level: 30.0 dBm

RF Channel: 903.0 MHz 65

Frequency Offset: + 0.000 kHz

Training Sequence: GSM 0

Wideband Power: – 17.7 dBm Peak

Fig. 4-37 Connection Control – Analyzer (softkey)

Max. Level

The *Max. Level* softkey sets the maximum expected input level (overload level). This level corresponds to the maximum peak envelope power (PEP) of the GSM signal that the CMU is able to measure. For GSM signals, the PEP is very close to the average burst power (low crest factor), however, it is appropriate to allow for a display margin of a few dB. Input levels exceeding the *Max. Level* overdrive the input path and cause invalid results ("– – –").

In the table-oriented version of the *Analyzer* tab, either manual or automatic setting of the input level can be selected. The behavior of the *Max. Level* softkey depends on the way the input level is set:

- In manual mode, the input level is indicated in the input field to the right of the softkey. This field can be activated and the level can be changed by pressing the *Max. Level* softkey. Note the remarks on external output attenuation on p. 4.73.
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. *Max. Level* is not active. To change the input level and mode, the table-oriented *Analyzer* tab must be opened by pressing the *Analyzer* hotkey again.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

RF Channel

The *RF Channel* softkey defines the channel number and frequency of the measured signal. The assignment between channel numbers and frequencies is defined in the GSM specification for both directions of transmission (uplink and downlink). Therefore, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically adjusted.

The following tables contain the channel assignment in the uplink direction (i.e. from mobile to base station/CMU). Compared to the downlink, all channel frequencies are shifted by a constant frequency offset depending only on the GSM band (duplex spacing, see Table 4-5 on p. 4.74). Channel numbers which are not listed in the tables are not assigned.

Table 4-4 GSM channels in the uplink direction

Frequency / [MHz]	Channel	GSM400 Band
0.2 ↓ 450.4	--- ↓ ---	–
450.6 ↓ 457.4	259 ↓ 293	GSM 450 band
457.6 ↓ 478.8	--- ↓ ---	
479.0 ↓ 485.8	306 ↓ 340	GSM 480 band
486.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM900 Band
0.2 ↓ 876	--- ↓ ---	–
876.2 ↓ 880	955 ↓ 974	R-GSM band (European railway netw.)
880.2 ↓ 889.8 890.0	975 ↓ 1023 0	E-GSM band (extended GSM)
890.2 ↓ 914.8	1 ↓ 124	P-GSM-Band (primary GSM)
915 ↓ 2700	↓ ---	–

Frequency / [MHz]	Channel	GSM1800 Band
0.2 ↓ 1710	--- ↓ ---	–
1710.2 ↓ 1784.8	512 ↓ 885	GSM 1800 band
1785 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1900 Band
0.2 ↓ 1850	--- ↓ ---	–
1850.2 ↓ 1909.8	512 ↓ 810	GSM 1900 band
1910 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM850 Band
0.2 ↓ 824.0	--- ↓ ---	–
824.2 ↓ 848.8	128 ↓ 251	GSM 850 band
849.0 ↓ 2700	--- ↓ ---	–

According to the channel width of the three GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control
`[SENSe:]RFANalyzer:CHANnel <Number>`

Frequency Offset

The Frequency Offset softkey defines an offset for the frequency set under RF Channel. This enables fine tuning of the frequency measured by the CMU, e.g. in order to simulate a Doppler shift (caused by a relative movement between mobile and base station) or detuning of the mobile.

Remote control
`[SENSe:]RFANalyzer:FREQuency:OFFSet <Number>`

Training Sequence

The Training Sequence softkey defines a training sequence for the measured signal.

The training sequence is located in the middle of the symmetrical normal burst and is used for synchronization and to assess the transmission conditions in the RF channel.

TB	Useful Information	F	Training sequence	F	Useful Information	TB	GP

TB	Tail bits (end or start bit)	Bits 0 to 2, 145 to 147
Useful information		Bits 3 to 59, 88 to 144
F	Flag Bit, Stealing Flag	Bits 60, 87
Training sequence		Bits 61 to 86
GP	Guard Period, transmission-free time of 8.25 bit periods	

Fig. 4-38 Bit structure of a GSM normal burst

Compared to a normal burst, the access burst (see section *Limit lines (Power Configuration – Limit Lines)* on page 4.31) has a longer guard period (68.25 bit instead of 8.25 bit) whereas the useful duration is shortened by 60 bits.

Here the training sequence is used to distinguish different burst types: If a definite training sequence is specified, the CMU only analyzes bursts with this training sequence. The following settings are provided:

GSM 0 to 7	GSM standard training sequences
Dummy	GSM-specific dummy burst
Off	Measurement of all bursts regardless of their training sequence

GSM training sequences

The 8 standard training sequences *GSM 0 to GSM 7* are specified in the GSM standard.

TSC	training sequence code for numbering the sequences
Bit pattern	26-bit training sequence

They read as follows:

TSC	Bit pattern (Bits No. 61 to 86)
0	0 0 1 0 0 1 0 1 1 1 0 0 0 0 1 0 0 0 1 0 0 1 0 1 1 1
1	0 0 1 0 1 1 0 1 1 1 0 1 1 1 1 0 0 0 1 0 1 1 0 1 1 1
2	0 1 0 0 0 0 1 1 1 0 1 1 1 0 1 0 0 1 0 0 0 0 1 1 1 0
3	0 1 0 0 0 1 1 1 1 0 1 1 0 1 0 0 0 1 0 0 0 1 1 1 1 0
4	0 0 0 1 1 0 1 0 1 1 1 0 0 1 0 0 0 0 0 1 1 0 1 0 1 1
5	0 1 0 0 1 1 1 0 1 0 1 1 0 0 0 0 0 1 0 0 1 1 1 0 1 0
6	1 0 1 0 0 1 1 1 1 1 0 1 1 0 0 0 1 0 1 0 0 1 1 1 1 1
7	1 1 1 0 1 1 1 1 0 0 0 1 0 0 1 0 1 1 1 0 1 1 1 1 0 0

Note: *In Signalling Mode, no training sequence but signalling parameters such as the color code of the base station can be specified for analyzed signals. This also serves to search for bursts with a particular characteristic.*

Remote control

```
[SENSe:]RFANalyzer:TSEQuence <Number>
```

Wideband Power

The *Wideband Power* softkey controls the wideband power measurement and indicates its status *(RUN | HLT | OFF).* The status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result is in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the *Max. Level:* The display range is between *Max. Level – 10 dB* and *Max. Level + 10 dB*.

The wideband power measurement is performed at the Front End of the CMU and yields the peak power of the input signal inside a wide frequency range. For GMSK modulated GSM signals, the result of the wideband power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics. The main purpose of the wideband power measurement is to indicate whether an input signal is available and whether it is advisable to change the *Max Level* settings.

Note: *An additional quick and precise power measurement is available in remote control (keyword `NPOWer`).*

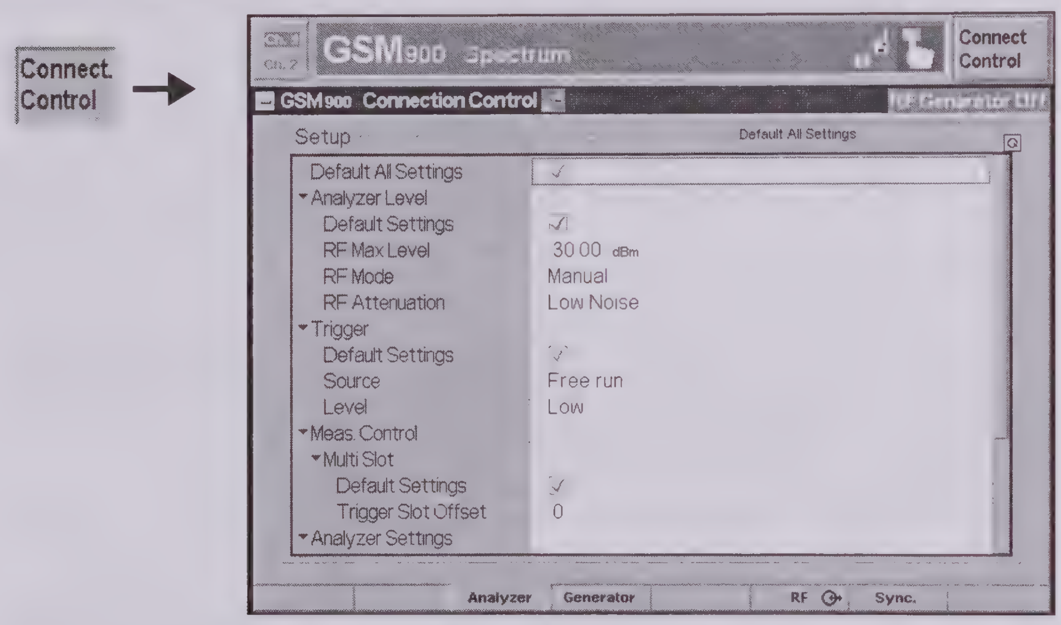
Remote control

```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

Table-Oriented Version

The table-oriented version of the *Analyzer* tab controls:

- The maximum expected input level *(RF Max. Level)* and the way it is defined *(RF Mode)*
- An external input attenuation or gain *(RF Attenuation)*
- The trigger conditions for the measurement *(Trigger)*
- The delay time (integer number of GSM timeslots) between the trigger time and the measured timeslot *(Trigger Slot Offset)*
- All *Analyzer Settings* described in section *Softkey-Oriented Version* on p. 4.66 ff.



Setup	
Default All Settings	✓
Analyzer Level	
Default Settings	✓
RF Max Level	30.00 dBm
RF Mode	Manual
RF Attenuation	Low Noise
Trigger	
Default Settings	✓
Source	Free run
Level	Low
Meas. Control	
Multi Slot	
Default Settings	✓
Trigger Slot Offset	0
Analyzer Settings	

Fig. 4-39 Connection Control – Analyzer (table)

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
–

Analyzer Level – RF Mode The *Analyzer Level* table section sets the maximum input level that can be measured. The maximum input level is displayed next to the softkey *Max. Level* in the main menu *Analyzer/Generator* (see page 4.2) and in the parameter lines above the graphical measurement menus. Two alternative *RF Modes* for defining this value are provided:

Manual	Manual input of maximum input level in the *RF Max. Level* field
Auto	Automatic setting of maximum input level *(autoranging)* according to the peak power (PEP) of applied signal

Remote control
`[SENSe:]LEVel:MODE <Mode>`

Analyzer Level – RF Max. Level

The maximum expected input level can be entered in the *RF Max. Level* input field. Input levels exceeding the *RF Max. Level* overdrive the input path and cause invalid results ("– – –").

External input attenuation

The range of *RF Max. Level* values depends on the RF input used. If an external input attenuation is reported to the instrument to compensate for a known path loss (see section *RF Connectors (Connection Control – RF)* on page 4.76), all levels measured are referenced to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.

Error messages

If the value determined for *RF Max. Level* is too high or too low, a window with the error message *"<Max_Level> is out of range. <permissible max. value> is limit."* and three fields will appear:

Accept	The permissible max. value is accepted as *RF Max. Level*,
Re-edit	*RF Max. Level* is entered once again,
Cancel	The last valid input value is maintained.

When switching over to another input, the current value of *RF Max. Level* is automatically adapted, if required:

- Towards lower values to the maximum value of the new input,
- Towards upper values to the minimum value of the new input.

Note: *A maximum input level can be entered even if automatic level setting (autoranging) is selected. The entered level is used as a start value for the autoranging routine and is also important to ensure safe switchover to manual setting.*

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

Analyzer Level – Attenuation

The *Attenuation* field defines how the RF analyzer of the CMU is tuned to meet the requirements of the current measurement type. In general, a compromise between the acceptable noise level in the displayed result and the contribution of internally generated distortion must be reached.

Normal	Mixer level in normal range,
Low noise	Mixer level enhanced by +10 dB (full dynamic range of CMU, therefore recommended for *Power* and *Spectrum* measurements),
Low distortion	Mixer level reduced by –10 dB (high intermodulation spacing, therefore recommended for *Modulation* measurements).

The *Attenuation* setting permits the CMU to be adapted to the requirements of the measurement. The advantages and disadvantages of the settings *Low noise* and *Low distortion* are listed in the following table.

	Advantages	**Disadvantages**
Low noise	Low noise high dynamic range	No RF overdrive reserve Risk of intermodulation
Low distortion	High intermodulation spacing	Lower dynamic range

Remote control
`[SENSe:]LEVel:ATTenuation NORMal | LNOise | LDIStortion`

Trigger – Source

The *Source* field determines how the measurement is triggered:

Free Run	Trigger by the GSM input signal: The CMU detects the burst; the exact timing is given by the training sequence. This setting may slow down the measurements. *P/t Multislot, Power/Slot*, and *Power/Frame* measurements can not be performed in *Free Run* trigger mode.
RF Power	Triggering on the power (rising edge) of the incoming burst, wideband power trigger on the RF Front End
IF Power	Narrow-band IF power trigger
Extern	External trigger signal fed in via connector AUX3 (pin no. 8)

For the *Free Run, RF Power* and *IF Power* settings the input signal must be a burst signal. The external trigger can be selected for all *Non Signalling* measurements. In contrast, *Signalling* measurements must be triggered by the signal from the signalling unit or from the mobile phone.

Remote control

```
TRIGger[:SEQuence]:SOURce FRUN | EXTern
```

Level

The *Level* field determines the trigger threshold if the measurement is triggered by the *RF Power* or *IF Power*.

The trigger threshold is the level at which the trigger signal starts triggering. With free-run measurements or external trigger the *Trigger Level* field is disabled.

Low	Low trigger level, equal to the reference level –26 dB
Medium	Medium trigger level, equal to the reference level –16 dB
High	High trigger level, equal to the reference level –6 dB

Remote control

```
TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH
```

Generator Settings (Connection Control – Generator)

The *Generator* tab controls and configures the RF generator. It defines.

- The level for the used and unused timeslot (measurement control softkey *RF Generator*)
- The generator frequency *(RF Channel, Frequency Offset)*
- A *Training Sequence* and a *Bit Modulation* sequence for the generated RF signals
- The *Transmission* mode (continuous or burst signal)

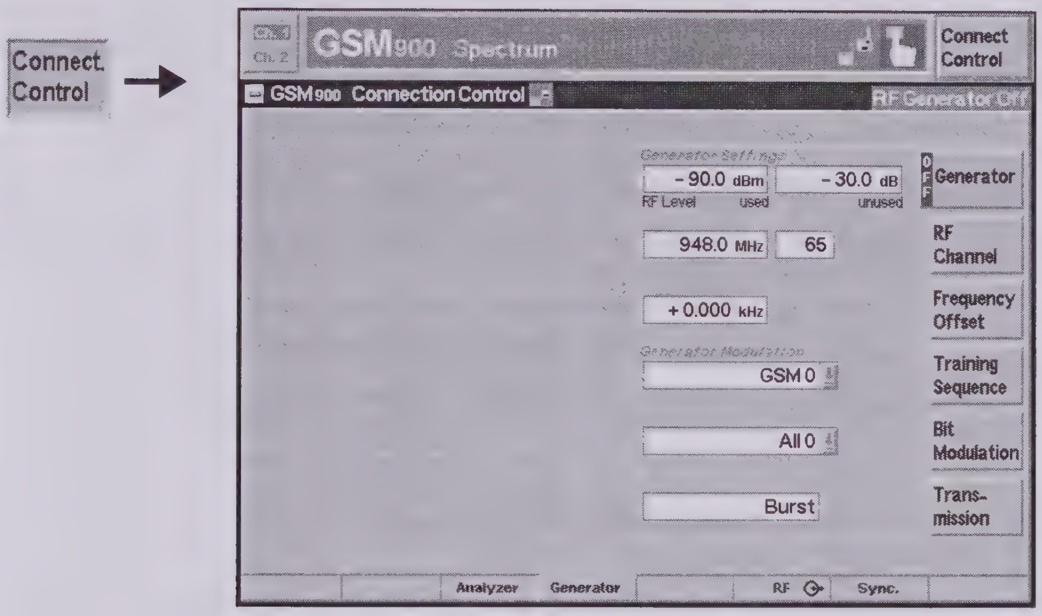


Fig. 4-40 Connection Control – Generator

Generator

The *Generator* softkey defines the generator level and indicates the operating status of the RF generator *(ON* or *OFF)*. Pressing the *Generator* softkey and the *ON/OFF* key switches the generator on or off.

For the generator level, a distinction is made between the used timeslot (selected and used for later measurements) and the remaining, unused timeslots. This feature is useful for many tests specified for GSM mobile phones. E.g. the adjacent time slot level is set to a higher value than the used time slot level in order to test whether the mobile receiver can quickly adapt to fast level changes.

Remote control
`INITiate:RFGenerator`
`ABORt:RFGenerator`
`FETCh:RFGenerator:STATus?`

Used

The level is indicated as absolute value (in dBm).

Remote control
`SOURce:RFGenerator:LEVel:UTIMeslot <Level>`

Unused

The level is defined relative to the level in the used timeslot (in dB). The absolute level in the unused timeslots, i.e. the sum of numerical values set under used and unused must lie within the permissible range for the RF outputs. This condition further restricts the permissible level for the unused timeslots.

External output attenuation

If an external output attenuation or gain is known and reported to the instrument (see softkey *Ext. Att. Output)* the RF generator level is adjusted to maintain the commanded power after the attenuation or gain. As a consequence, all levels indicated are referred to the input of the DUT and no longer correspond to the actual level at the output connectors of the CMU (see section *RF Connectors (Connection Control – RF)* on page 4.76). The default value for the generator power is also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.

Error messages

If the level defined for RF Level is too high or too low, a window will appear with the error message "<RF_Level> is out of range. <Permissible max. value> is limit." and three fields:

Accept	Permissible max. value is accepted as generator level
Re-edit	The generator level is entered once again
Cancel	The last valid input is maintained

When switching over to a different output, the current value of the generator level is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new output
- Towards higher values to the minimum value of the new output

Remote control
`SOURce:RFGenerator:LEVel:UNTimeslot <Level>`

RF Channel

The *RF Channel* softkey defines the channel number or the frequency of the generated RF signal.

The assignment of channel numbers and frequencies is unambiguously defined in the GSM specification for both directions of transmission. Therefore, it is sufficient to enter only one value (frequency or channel number), the other one is automatically determined by the CMU.

The following tables contain the channel assignment in the downlink direction (i.e. from base station/CMU to mobile). Compared to the uplink, all channel frequencies are shifted by a constant frequency offset depending only on the GSM band (duplex spacing, see Table 4-4 on p, 4.67). Channel numbers which are not listed in the tables are not assigned.

Table 4-5 GSM channels in the downlink direction

Frequency / [MHz]	**Channel**	**GSM400 Band**
0.2 ↓ 460.4	--- ↓ ---	–
460.6 ↓ 467.4	259 ↓ 293	GSM 450 band
467.6 ↓ 488.8	--- ↓ ---	
489.0 ↓ 495.8	306 ↓ 340	GSM 480 band
496.0 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	**Channel**	**GSM900 Band**
0.2 ↓ 921	--- ↓ ---	–
921.2 ↓ 925	955 ↓ 974	R-GSM band (European railway netw.)
925.2 ↓ 934.8 935.0	975 ↓ 1023 0	E-GSM band (extended GSM)
935.2 ↓ 959.8	1 ↓ 124	P-GSM-Band (primary GSM)
960 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1800 Band
0.2 ↓ 1805	--- ↓ ---	–
1805.2 ↓ 1879.8	512 ↓ 885	GSM 1800 band
1880 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM1900 Band
0.2 ↓ 1930	--- ↓ ---	–
1930.2 ↓ 1989.8	512 ↓ 810	GSM 1900 band
1990 ↓ 2700	--- ↓ ---	–

Frequency / [MHz]	Channel	GSM850 Band
0.2 ↓ 869.0	--- ↓ ---	–
869.2 ↓ 893.8	128 ↓ 251	GSM 850 band
893.0 ↓ 2700	--- ↓ ---	–

According to the channel width of the three GSM bands, the RF frequency can be set in multiples of 200 kHz. It can be modified by an additional *frequency offset* entered in the input field below.

Remote control
`SOURce:RFGenerator:FREQuency[:CHANnel] <Number>`

Frequency Offset

The *Freq. Offset* softkey defines a frequency offsetshifting the frequency set under RF Channel. This enables fine tuning of the RF frequency generated by the CMU, e.g. in order to simulate a Doppler shift (caused by a relative movement between mobile and CMU) or detuning of the mobile.

Remote control
`SOURce:RFGenerator:FM:DEViation <FrequencyOffset>`

Training Sequence

The *Training Sequence* softkey defines the training sequence that is superimposed on the RF carrier signal. The following settings are possible:

GSM 0 to 7	GSM standard training sequences
Dummy	GSM-specific dummy burst

The 8 GSM standard training sequences are listed above (see page 4.69).

Remote control
```
CONFigure:RFGenerator:MODulation:TSEQuence:SELection
                          GSM0 | ... | GSM7 | DUMMy
```

Bit Modulation

The *Bit Modulation* softkey defines a bit sequence that is modulated onto the RF carrier signal. The following types of modulation sequence can be selected:

Off	No signal superimposed, "empty" carrier
All 0	Modulation sequence consisting of zeros
PRBS	Pseudo random bit sequence
Dummy Bursts	Fixed bit sequences (Dummy Bursts) with selectable training sequence, see next softkey
8PSK All 0	Modulation sequence consisting of zeros, 8PSK modulation
8PSK PRBS	Pseudo-random bit sequence, 8PSK modulation

Remote control
```
CONFigure:RFGenerator:MODulation:BIT:SELection
  OFF | PRBS | DUMMyburst | ALL0 | EALL0 | EPRBS
```

Trans-mission

The softkey *Transmission* determines the shape of the generated RF signal. The RF generator generates either a burst or a continuous signal, i.e. a carrier with a constant level.

Remote control
```
CONFigure:RFGenerator:MODulation:TRANsmission
                              BURSt | CONTinuous
```

RF Connectors (Connection Control – RF)

The *RF* tab (function group *GSM400/850/900/1800/1900-MS*, *Non Signalling* mode) configures the connectors for RF signals. This includes the setting of

- The RF input and output of the CMU *(RF Output, RF Input)*
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*

The tab also controls the wideband peak power measurement *(Wideband Power)* and indicates the result. The name and function of the AF connectors is indicated in addition.

Connect. Control →

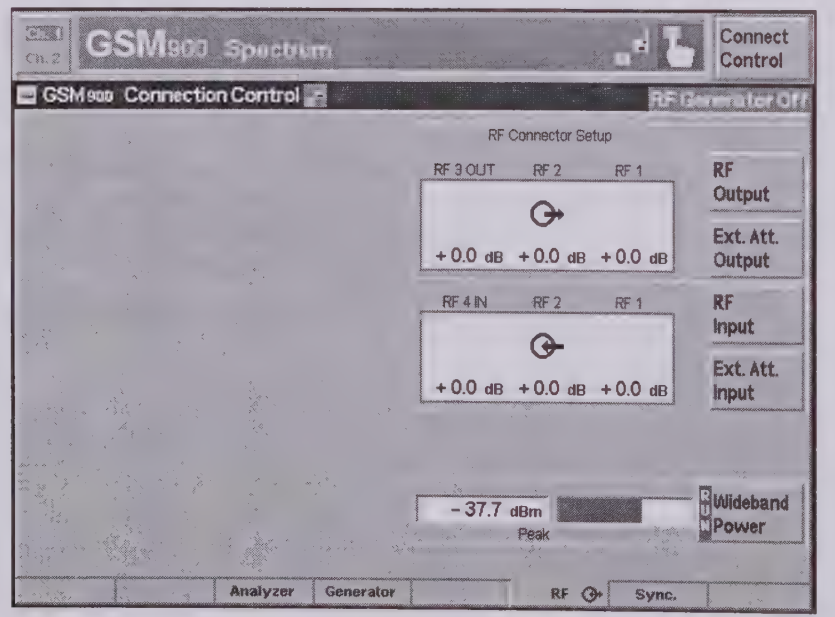


Fig. 4-41 Connection Control – RF connectors

The *Wideband Power* measurement is explained in section *Softkey-Oriented Version* on p. 4.66 ff.

RF Output

The *RF Output* softkey defines which of the three connectors RF 1, RF 2 and RF 3 OUT is to be used as RF output connector. A symbol ⊖→ indicates the selected RF output.

Note: *Input and output connectors can be arbitrarily combined. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

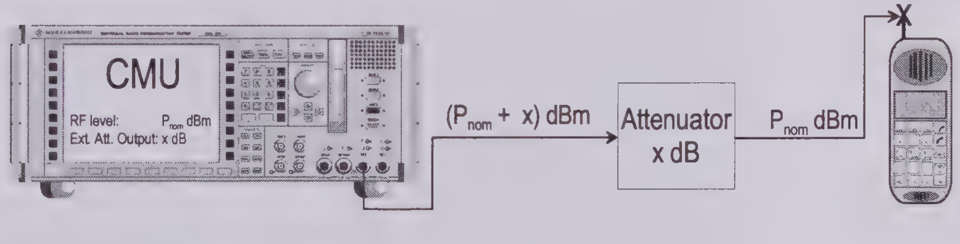
The LEDs on the front panel are only „on“ (light) if the output level is switched on.

Remote control
`OUTPut[:STATe] RF1 | RF2 | RF3`

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected RF output. Input of an external attenuation is suitable if, for example, if a path attenuation (cable) is included in the test setup, which is to be corrected by an increased signal level.

If an external attenuation is defined, the output signal level is referred to the input of the DUT, the generator level is therefore shifted with respect to the actual level at the input connector of the CMU. The default value for the generator power and the level ranges for the RF outputs are also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.



Remote control
`[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]`

RF Input

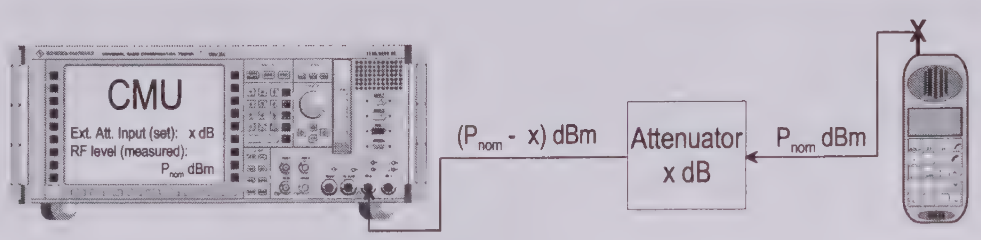
The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector. If a connector is selected as RF input, a symbol ⊖← will appear in the respective field. Input and output connectors can be arbitrarily combined.

Remote control
`INPut[:STATe] RF1 | RF2 | RF4`

Ext. Att. Input

The softkey *Ext. Att. Input* enters the value of the external attenuation (or gain) at the selected RF input. Input of an external attenuation is required if, for example, external attenuator pads are used for protection of the sensitive RF inputs of the CMU or if a path attenuation is included in the test setup.

If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control –* on page 4.76), all levels measured are referred to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.



Note: The LEDs on the front panel are only "on" (light) if the measurement is active.

Remote control

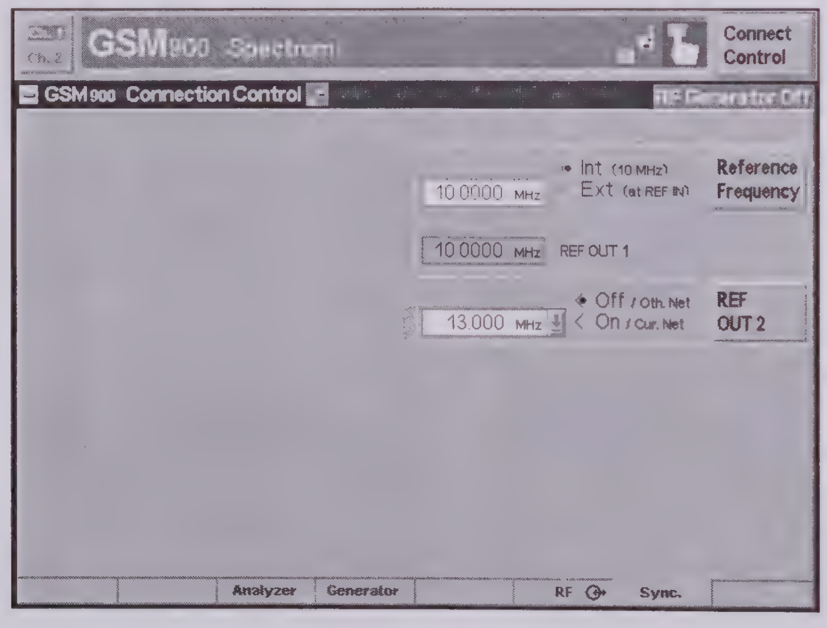
```
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]
```

Reference Frequency (Connection Control – Sync.)

The *Sync.* tab defines the reference signals for synchronization. This includes

- The internal or external *Reference Frequency*,
- The output mode for the network-specific system clock *(REF OUT 2)*.

Connect. Control →



● Int (10 MHz) / ○ Ext (at REF IN): 10.0000 MHz — Reference Frequency

10.0000 MHz REF OUT 1

● Off / Oth. Net / ○ On / Cur. Net: 13.000 MHz — REF OUT 2

Fig. 4-42 Connection Control – Synchronization

Reference Frequency

The *Reference Frequency* softkey determines the source and the frequency of the reference signal.

The associated field permits to select between two alternatives:

Int. (10 MHz)	Internal synchronization with 10 MHz (TCXO or OCXO, CMU-B11/-B12) applied to output REF OUT 1 at the rear of the instrument.
Ext. (at REF IN)	External reference signal to be fed in via input *REF IN* and applied to output REF OUT 1 at the rear of the instrument.

The frequency of the external reference signal must be entered in the input field next to the left of the *Ext. (at REF IN)* radio button.

The reference signal used is applied to output *REF OUT 1* so that it can be fed to other instruments as well. It can be used for synchronization to another instrument.

Notes:

1. *With external synchronization selected, the header cyclically displays a warning if no synchronization has been performed e.g. because of missing or faulty input signal. At the same time, bit no. 6 (RFNL, Reference Frequency Not Locked) is set in the STATus:OPERation:CMU:SUM1:CMU1 sub-register associated to the CMU base system.*
2. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching to avoid reflections. Otherwise, resulting overshoots may cause trigger problems at the CMU input. A possible remedy is to use a lowpass filter or an attenuator pad directly at the CMU input. Correct synchronization may be checked by comparing the signal REF OUT 1 or REF OUT 2 with the input signal.*
3. *This configuration is valid in all CMU function groups.*

Remote control
The commands for the reference frequency are part of the CMU base system (see CMU200/300 operating manual):

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
  INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
```

REF OUT 2

The softkey *REF OUT 2* configures a network-specific system clock REF OUT 2 to be fed to the output REF OUT 2 at the rear of the instrument.

The associated field permits to select between two alternatives:

OFF (other network)	The clock frequency of the current function group is not fed to the output *REF OUT 2*. With this setting the system clock of another active function group (e.g. the network GSM1800 while the current network is GSM900) is still applied to *REF OUT 2* provided that the output *REF OUT 2* is switched on in the other function group. However, if *REF OUT 2* is explicitly switched over from *On* to *Off* the clock signal is definitely removed.
On (current network)	The network-specific system clock of the current function group is fed to output REF OUT 2. The system clock of any other function group applied to REF OUT 2 before is replaced.

Besides the basic clock frequency of 39 MHz one of the following clock frequencies may be selected:

39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz,
4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz,
2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz,
1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz,
1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz

(The values are calculated according to the formula F_{out} = *39.000 MHz / n* where *n = 1, ..., 32.*)

The clock frequency can be used to synchronize other instruments.

Remote control

```
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

GSM Mobile Tests (Signalling)

The structure of this section is based on the configuration and measurement groups defined in function group *GSM400/850/900/1800/1900-MS Signalling*, i.e. on the menus of the graphical user interface. The menus are described in the following order:

1. Call setup to the mobile station *(Connection Control – Signal)*
2. Overview of measurements and global settings *(Overview)*
3. Measurement menus *(Power, Modulation, Spectrum, Receiver Quality):* Purpose of the measurements and relation to the test specifications and conformance requirements, description of measurement results, specific measurement configurations
4. General device configurations *(Connection Control)*

The most important menus within function group *GSM400/850/900/1800/1900-MS Signalling* are shown in an overview at the end of chapter 3 in the present GSM manual.

A lot of menus and controls are identical in the two test modes *Signalling* and *Non Signalling*. In this chapter, these menus will only be presented with a summary explanation; the detailed description can be found in the section *GSM400/850/900/1800/1900-MS Non Signalling.*

Setup of a Connection

The menu group *Connection Control* controls signalling (call setup and release, services, signalling parameters) and configures the inputs and outputs with the external attenuation values and the reference frequency.

The term signalling summarizes all procedures that are necessary for call setup and release and for control of a connection in the mobile radio network. In the case of the CMU, a distinction is made between five different signalling states:

Signal Off	CMU transmits no signal
Signal On	CMU transmits a GSM control channel signal to which a mobile station can synchronize
Synchronized	Synchronization with the mobile station and location update performed
Alerting	Mobile is being called by the CMU (after location update or without location update)
Call Established	Call to mobile station established

A number of control commands which can be initiated both by the CMU *(Connect Mobile, Mobile Terminating Call)* and by the mobile station *(Call from MS, Mobile Originated Call)* switch between these states (in Fig. 4-43, processes initiated by the mobile station are indicated by dashed lines).

A lot of applications within the function group *GSM400/850/900/1800/1900-MS Signalling* are only possible or useful in a particular signalling state (for example, handover between various networks requires an existing connection between CMU and mobile station, i.e. it is only possible in the *Call Established* state). Accordingly, the possible functions of menus vary depending on the present signalling state. For reference see the *Sig. State* field in the command tables in Chapter 6.

The purpose of the *Signalling* test mode is to perform transmitter and receiver tests with an existing call (or data transfer) connection between the CMU and the mobile. Therefore the menus for setting up a connection (*Connection Control – Connection)* appear immediately after the function group and mode *GSM400/850/900/1800/1900-MS Signalling* is activated. Besides, all the tabs in the *Connection Control* menu can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. Pressing the *Escape* key closes the active *Connection Control* menu and re-activates the underlying measurement menu.

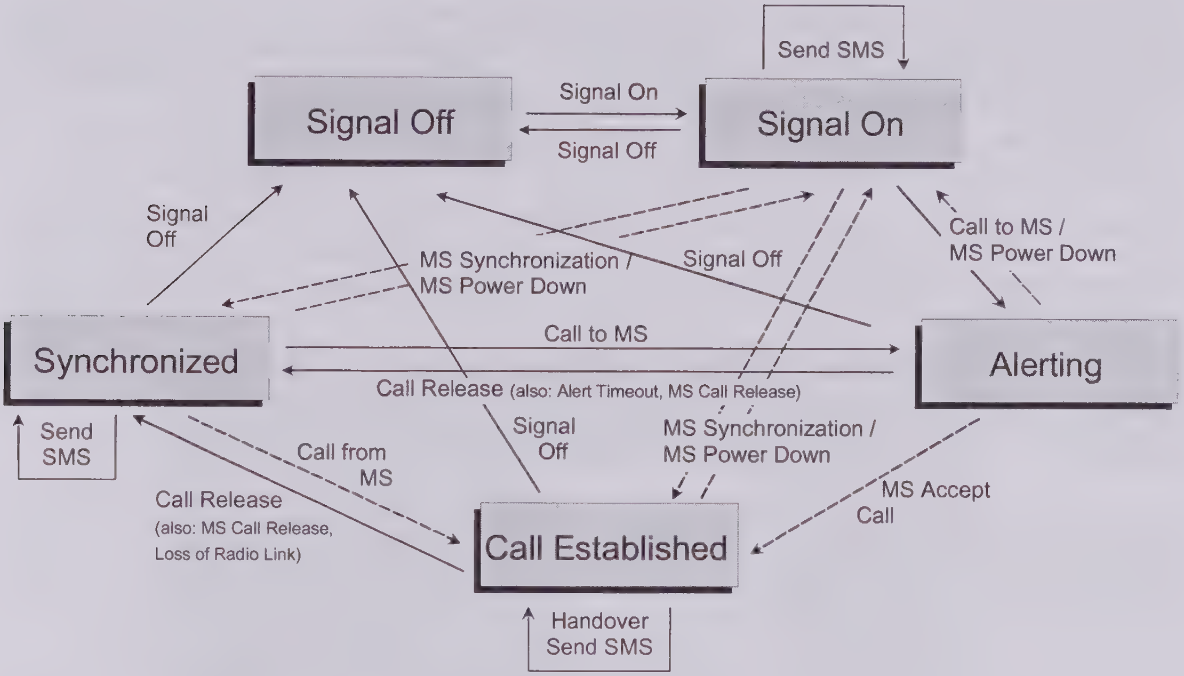

Send SMS
Signal Off
Signal On
Signal On
Signal Off
Signal Off
MS Synchronization / MS Power Down
Signal Off
Call to MS / MS Power Down
Synchronized
Call to MS
Alerting
Call Release (also: Alert Timeout, MS Call Release)
Send SMS
Signal Off
MS Synchronization / MS Power Down
Call from MS
Call Release (also: MS Call Release, Loss of Radio Link)
MS Accept Call
Call Established
Handover Send SMS

Fig. 4-43 Signalling states of the CMU (circuit switched mode)

Corresponding to the five possible signalling states, five different *Connection* tabs are available. When a signalling state is reached, the corresponding menu is opened automatically (exception: see softkey *Open Pop. autom.*).

Note1: Handover

For a complete overview of signalling states including the Handover process see Fig. 6.1 in chapter 6 of this manual.

Note2: Packet switched mode (GPRS)

The connection scheme described in this section is designed and valid for circuit switched traffic (GSM, HSCSD or EDGE). With option CMU-K42, the CMU is also able to test the packet switched operating mode of mobile phones supporting GPRS. GPRS is an additional mode of the MS so that the circuit switched GSM signalling scheme of Fig. 4-43 above is complemented by a largely independent GPRS signalling scheme. For a detailed description of the CMU's GPRS functionality see section GPRS Signalling on p. 4.157 ff.

In the following the first two tabs *Connection Control – Connection* displayed during the call setup are described. The other tabs of the *Connection Control* menu provide general measurement settings; they are described in section *Connection Control* on p. 4.125 ff.

Signalling Control without Signal (State Signal Off)

The *Connection (Signal Off)* tab provides information on:

- The current GSM *(Circuit Switched)* and GPRS *(Packet Switched)* signalling states
- The characteristics of the MS under test *(MS Capabilities* and *Signalling Info*, if available, i.e. if a connection was set up before)
- The most important parameters characterizing the frequency and level of the signal sent by the CMU in the state Signal On *(BS Signal)*
- The *Network* code

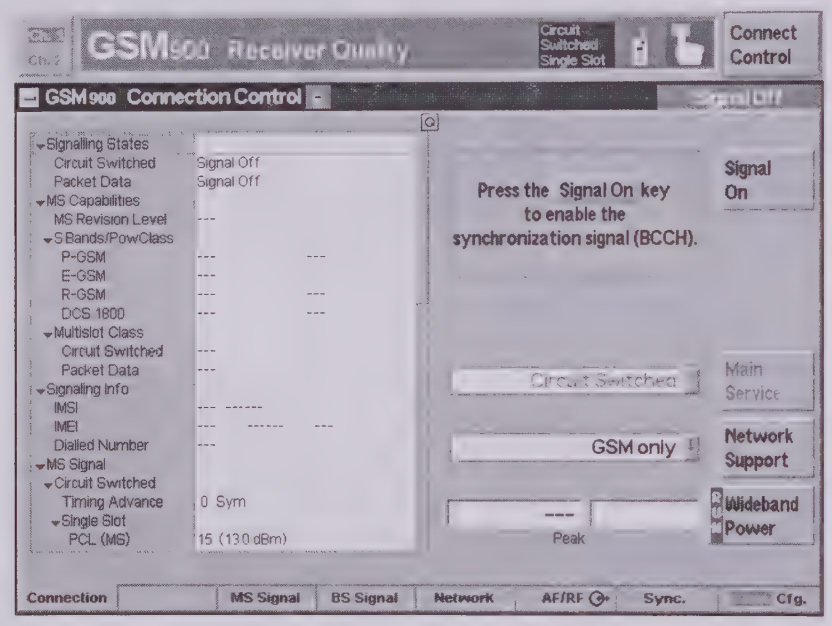
- Selected AF and RF connectors and external attenuation *(AF/RF ⊖→)*
- Status and result of wideband peak power measurement *(Wideband Power)*

Besides, it contains softkeys which lead to other operating modes or signalling states:

- Select another operating mode of the MS, e.g. GPRS mode *(Network Support* and *Main Service)*
- Activate the control channel signal to which the mobile station can synchronize *(Signal On)*

The popup menu *Connection (Signal Off)* is opened when the function group *GSM-MS Signalling* is selected, or if the control channel signal is switched off *(Signal Off* softkey*)* while the system is in another signalling state. It is replaced by the *Connection (Signal On)* menu after the control channel signal on the CMU is switched on (Softkey *Signal On,* see Fig. 4-43).

Connect. Control →



Signalling States
Circuit Switched Signal Off
Packet Data Signal Off
MS Capabilities
MS Revision Level ---
S.Bands/PowClass
P-GSM --- ---
E-GSM ---
R-GSM --- ---
DCS 1800 --- ---
Multislot Class
Circuit Switched ---
Packet Data ---
Signaling Info
IMSI --- ------
IMEI --- ------ ---
Dialled Number ---
MS Signal
Circuit Switched
Timing Advance 0 Sym
Single Slot
PCL (MS) 15 (13.0 dBm)

Press the Signal On key to enable the synchronization signal (BCCH).

Peak ---

Fig. 4-44 Connection Control – Connection (Signal Off)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection Control with Call Established* on p. 4.128 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message (here: *Press the Signal On key to enable the synchronization signal (BCCH))* displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal On

The *Signal On* softkey switches on a control channel signal to which the mobile station can synchronize. By switching on the signal, the CMU changes to the signalling state *Signal On*. A user prompt below the header indicates the function of this softkey.

Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion SON`

Main Service

The *Main Service* softkey selects *Circuit Switched* or *Packet Data* (GPRS) operation of the MS under test. This softkey is disabled (grayed) if the *Network Support* is set to GSM. On the other hand, selecting *Packet Data* as main service disables the *Network Support* softkey. See also section GPRS Signalling on p. 4.157 ff.

Remote control
`[:SENSe:]NETWork:MSERvice`

Network Support

The *Network Support* softkey determines whether the CMU acts as a BTS that supports GSM only or GSM and GPRS.

GSM	Circuit switched GSM operation without GPRS support
GSM + GPRS	Circuit switched GSM operation with GPRS support: The CMU reports to the MS that the CMU/network supports GPRS. The MS can react to this message provided that it also supports GPRS.

The *Network Support* parameter is available only before the MS is synchronized (i.e. in the GSM signalling states *Signal Off* or *Signal On*). The *GSM + GPRS* setting is a pre-condition for all GPRS-related signalling procedures and measurements such as the *Main Service* selection.

The *Network Support* parameter is also disabled (and fixed to *GSM + GPRS)* if the *Packet Data* main service is selected, see above.

Remote control
`CONFigure:NETWork:NSUPport GSM | GGPR`

Wideband Power

The *Wideband Power* softkey controls the wideband power measurement and indicates its status *(RUN | HLT | OFF)*. The status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result is in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the expected level from the MS, i.e. the nominal output power corresponding to its power class and PCL. The display range is between *Nominal Power – 10 dB* and *Nominal Power + 10 dB*.

The wideband power measurement is performed at the Front End of the CMU and yields the peak power of the input signal inside a wide frequency range. For GMSK modulated GSM signals, the result of the wideband power measurement is usually slightly higher than the result of the *Power* measurement which is obtained with different filter characteristics. The main purpose of the wideband power measurement is to indicate whether an input signal is available and whether it is in the expected range.

Note: *An additional quick and precise power measurement is available in remote control (keyword* `NPOWer`*).*

Remote control

```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer?
FETCh[:SCALar]:WPOWer?
SAMPle[:SCALar]:WPOWer?
```

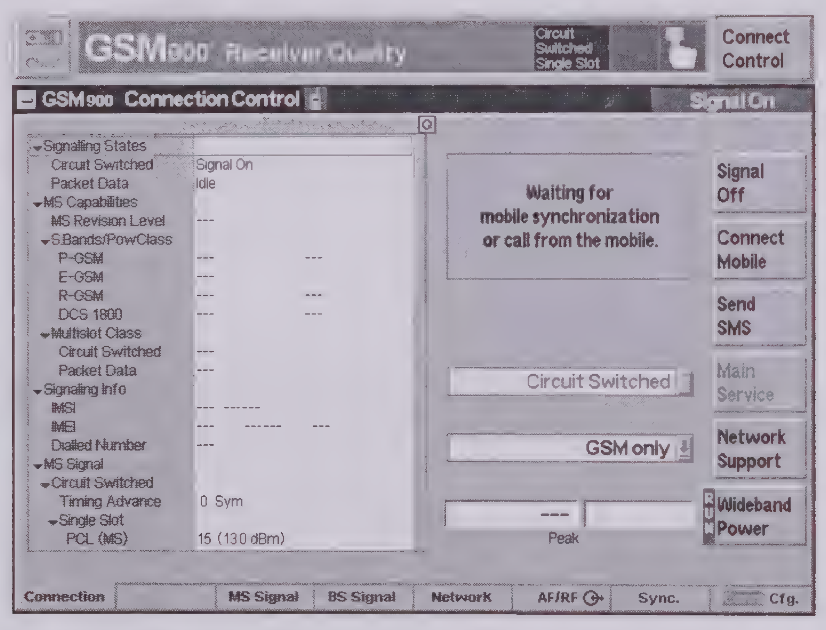
Connection Control with Signal (State Signal On)

In addition to the parameter overview described in section *Connection Control with Call Established* on p. 4.128 ff, the *Network Support* and *Main Service* softkeys, and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on p. 4.81 ff., the *Connection (Signal On)* tab contains the following softkeys which lead to other services or signalling states:

- Switch off the control channel synchronization signal *(Signal Off)*
- Set up a call to the mobile station (*Connect Mobile* -> state *Alerting)*
- Short message service (*Send SMS* -> return to state *Signal On)*

The popup menu *Connection (Signal On)* is opened after the control channel signal on the CMU is switched on (Softkey *Signal On* in the popup menu *Connection (Signal Off)*). It is replaced by the *Connection (Synchronized)* menu after the mobile station initiates a location update by itself. It is replaced by the *Connection (Call Established)* menu if the mobile station sets up a call to the CMU. It is replaced by the *Connection (Alerting)* menu if a mobile is called via the *Connect Mobile* softkey (see Fig. 4-43).

Connect. Control →



Signalling States		
Circuit Switched	Signal On	
Packet Data	Idle	
MS Capabilities		
MS Revision Level	---	
S.Bands/PowClass		
P-GSM	---	---
E-GSM	---	
R-GSM	---	---
DCS 1800	---	---
Multislot Class		
Circuit Switched	---	
Packet Data	---	
Signaling Info		
IMSI	--- ------	
IMEI	--- ------	---
Dialled Number	---	
MS Signal		
Circuit Switched		
Timing Advance	0 Sym	
Single Slot		
PCL (MS)	15 (13.0 dBm)	

Waiting for mobile synchronization or call from the mobile.

Circuit Switched

GSM only

Fig. 4-45 Connection Control – Connection (Signal On)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection Control with Call Established* on p. 4.128 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message (here: *Waiting for mobile synchronization or call from the mobile)* displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal Off

The *Signal Off* softkey switches off the CMU's control channel signal to which the mobile station can synchronize. The CMU changes to the signalling state *Signal Off*.

Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion SOFF`

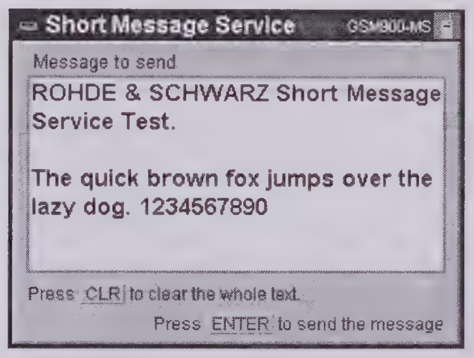
Connect Mobile

The *Connect Mobile* softkey sets up a call to the mobile station. The header message indicates that the mobile station is to synchronize to the CMU signal first. After successful synchronization, the two successive messages *Paging in progress ... Location update in progress ...* are displayed below the header; the CMU changes to the signalling state *Alerting*. As soon as the call is accepted at the mobile the CMU changes to the signalling state *Call Established*.

Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion MTC`

Send SMS

The *Send SMS* softkey activates the short message service.
It opens the *Short Message Service* popup menu:



Short Message Service
GSM900-MS
Message to send

ROHDE & SCHWARZ Short Message Service Test.

The quick brown fox jumps over the lazy dog. 1234567890

Press CLR to clear the whole text.
Press ENTER to send the message

A text with a maximum of 160 alphanumeric characters can be entered in the input field. Two front panel keys control the short message service menu:

CLR	Clear the whole short message from the input field
ENTER	Send the short message in the input field to the mobile.

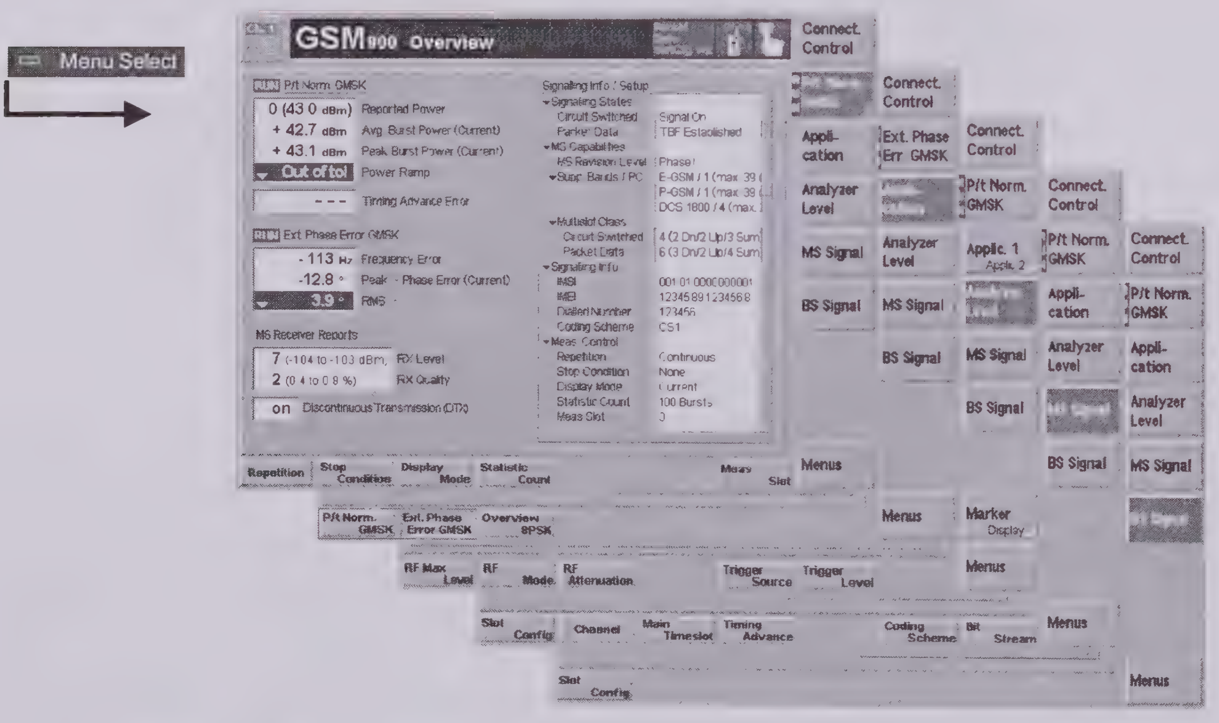
Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion SMS`
`CONFigure:SIGNalling[:CSWitched]:SMS <Text>`
`SENSe:SIGNalling[:CSWitched]:SMS?`

Overview Menu

The *Overview* menu displays the essential results of the *P/t Norm. GMSK*, the *Ext. Phase Err. GMSK*, and the *Overview 8PSK* applications and provides access to the most important measurement settings. In particular, it configures the GSM downlink signal that the CMU transmits in order to set up and control a connection *(BS Signal)* and defines the properties of the uplink signal expected from the device under test *(MS Signal)*. The *Overview* menu is analogous to the *Analyzer/Generator* menu described on p. 4.2 ff.

- The measurement control softkey (measurement control softkey) *P/t Norm. GMSK* changes to *Ext. Phase Err. GMSK* or *Overview 8PSK*, depending on the application selected. This softkey controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Power Configuration* or *Modulation Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* or *Modulation* measurement.
- The other softkeys on the right side are combined with various hotkeys (see Fig. 4-46 below). The softkey/hotkey combinations provide test settings and switch over between different measurements.

The main menu *Overview* is opened by selecting the function group in the main menu *Menu Select* (with associated key at the front of the instrument) and after closing the configuration menu *Connection Control - Connection* (using the *Escape* key or automatically after establishing a connection). The hotkeys associated to the *Menus* softkey switch over between the *Overview* menu and the remaining measurement menus of function group *GSM400/850/900/1800/1900-MS Signalling*.



RUN P/t Norm. GMSK
0 (43.0 dBm) Reported Power
+ 42.7 dBm Avg. Burst Power (Current)
+ 43.1 dBm Peak Burst Power (Current)
Out of tol Power Ramp
- - - Timing Advance Error

RUN Ext. Phase Error GMSK
- 113 Hz Frequency Error
-12.8 ° Peak - Phase Error (Current)
3.9 ° RMS

MS Receiver Reports
7 (-104 to -103 dBm) RX Level
2 (0.4 to 0.8 %) RX Quality
on Discontinuous Transmission (DTX)

Signaling Info / Setup
Signaling States
Circuit Switched: Signal On
Packet Data: TBF Established
MS Capabilities
MS Revision Level: Phase I
Supp. Bands / PC: E-GSM / 1 (max. 39 (; P-GSM / 1 (max. 39 (; DCS 1800 / 4 (max.
Multislot Class
Circuit Switched: 4 (2 Dn/2 Up/3 Sum)
Packet Data: 6 (3 Dn/2 Up/4 Sum)
Signaling Info
IMSI: 001 01 0000000001
IMEI: 12345 89 1234568
Dialled Number: 123456
Coding Scheme: CS1
Meas. Control
Repetition: Continuous
Stop Condition: None
Display Mode: Current
Statistic Count: 100 Bursts
Meas Slot: 0

Fig. 4-46 Function overview – Overview

Test Settings

The settings for the *Overview* menu are accessible via softkey/hotkey combinations. The function of the measurement control softkeys *P/t Norm. GMSK, Ext. Phase Err. GMSK*, and *Overview 8PSK* is analogous to the measurement control softkeys in the *Analyzer/Generator* menu; see section *Measurement Control* on p. 4.4. The same holds for the selection of the application; see section *Selecting the Application* on p. 4.5.

The *Overview* menu provides a number of general or application-specific settings. All of these settings are always identical to the corresponding settings in the *Power* and *Modulation* menus. Changes made in the *Overview* menu overwrite the *Power* and *Modulation* settings and vice versa.

Description of settings

- The settings to be made in the *P/t Normal GMSK* application are described in section *Test Settings* on p. 4.89 ff.
- The settings associated to the measurement control softkey and the *Analyzer Level* settings to be made in the *Ext. Phase Error GMSK* and in the *Overview 8PSK* application are identical with the corresponding settings in the *Analyzer/Generator* menu. The *MS Signal* and *BS Signal* settings are described in section *Test Settings* on p. 4.89 ff.

Setup table

The *Setup* table in the right half of the *Overview* menu gives an overview of the measurement settings belonging to the current application. It changes when a different application is selected. The rollkey scrolls and expands the *Setup* table.

Measurement Results

The measurement results and their relation to the three measurement applications are analogous to the results in the *Analyzer/Generator* menu; see section *Measurement Results* on p. 4.6 f. The results in the *Overview* menu represent only a small fraction of the power and modulation results and of the MS reports that the CMU is able to acquire. A comprehensive set of test results is displayed in the *Power, Modulation,* and *Receiver Quality* measurement menus. More information about the measurement results is to be found in the documentation on these measurement menus:

Power	Burst power	*Power* menu, p. 4.88 ff.
Ext. Phase Err. GMSK	Modulation (phase and frequency error)	*Modulation* menu, p. 4.105 ff.
MS Rcv. Reports	Measurement reports from mobile station	*Sensitivity* menu, p. 4.113 ff.

Power Measurements

The menu group *Power* is designed to measure the RF output power of the MS transmitter. The power of a normal burst in a single timeslot or in up to 4 consecutive timeslots, the power of an access burst, the averaged power and its evolution over several slots or frames can be analyzed. In addition, the average power can be measured as a function of the power control level (PCL) of the mobile. The different measurements are treated as different applications; the results are displayed in separate *Power* measurement menus. The popup menu *Power Configuration* is used to configure the measurements.

Most applications and settings of the *Power* menu do not depend on the signalling state and correspond to those of the menu *Power* in the test mode *GSM400/850/900/1800/1900-MS Non Signalling*. For a detailed description of these applications refer to p. 4.9 ff. The following two applications are related to signalling issues and therefore not available in *Non Signalling* mode:

- Application *P/PCL*
- Application *P/t Access GMSK*

P/PCL

In *Signalling* mode, the average burst *Power* can be measured as a function of the PCL of the connected mobile phone. This parameter is not available under the conditions of a module test. Therefore, application *P/PCL* is not included in the *Non Signalling* measurements.

The *P/PCL* measurement represents a fast method of measuring the average burst power transmitted on all PCLs supported by a mobile. The measurement relies on the fact that a GSM mobile, when changing from one PCL to another, steps through the whole range of intermediate PCLs, dwelling on each level for a period corresponding to 13 TDMA frames (577 µs x 8 x 13 ≈ 60 ms). The CMU measures the average burst power in the whole PCL range, starting with the highest output power level (i.e. the smallest PCL, see Table 4-7 on page 4.103).

The P/PCL measurement is combined with frequency hopping on seven uplink GSM channels. In addition, a limit check with PCL-dependent tolerances is performed. The results are output in tabular form.

P/t Access GMSK

The *P/t Access GMSK* application measures the power of an access burst over one burst period. The measurement curve obtained can be further processed to determine an average, minimum, or maximum result and calculate the average over the whole burst. Access bursts are used by the mobile station for initial random access to the network and for handover, so they can be measured in *Signalling* mode only. As there is no mode where the mobile transmits access bursts in consecutive TDMA frames, only single shot measurements can be made. Besides, the *P/t Access GMSK* application is analogous to *P/t Normal GMSK.*

The properties and use of access bursts in GSM networks are described in section *Limit lines (Power Configuration – Limit Lines)* on page 4.31 ff.

Note: Power *measurements on normal bursts are performed at the MS output power set via* PCL *(see* PCL *softkey on p. 4.134) or the corresponding parameters for multislot or packet data mode. In contrast, the access burst is transmitted before a call is set up. The* P/t Access Burst *measurement is performed at the maximum power for the cell* PMAX *(see* PMAX *parameter on p. 4.139).*

Measurement Menu (Power)

The graphical measurement menu *Power* displays the results of the power measurement.

- The measurement control softkey *P/t Normal GMSK* (which changes to *P/Frame, P/PCL etc.*, depending on the power measurement application selected) controls the *Power* measurement, indicates its status *(RUN | HLT | OFF)*, and opens the configuration menu *Power Configuration*. The hotkeys associated to the measurement control softkey define the scope of the *Power* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the hotkeys *PCL, Channel, Timeslot,* and *Timing Advance* are associated with the softkey *MS Signal).* If

a softkey is selected and an associated hotkey pressed, a popup window will appear which indicates the current setting and enables an entry.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Menus* softkey and the *Power* hotkey.

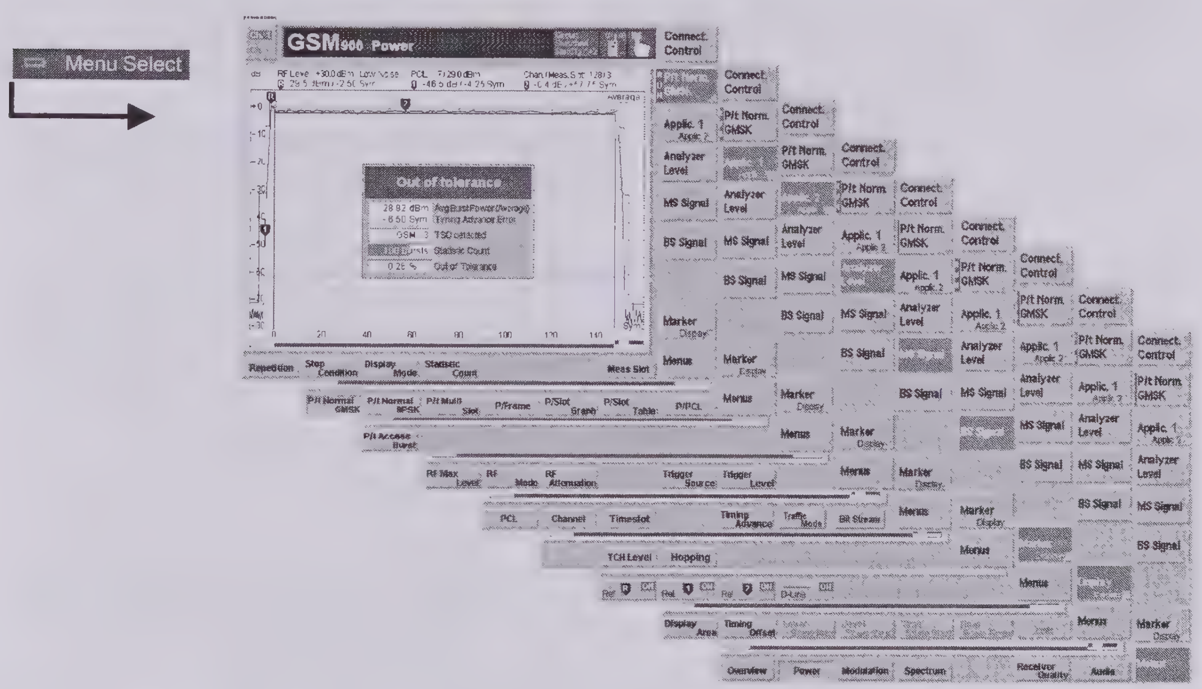


Fig. 4-47 Measurement menu Power – P/t Normal GMSK

Test Settings

The *P/t Norm. GMSK* measurement control softkey (which changes to *P/Frame, P/PCL etc.,* depending on the power measurement application selected) is analogous to the measurement control softkey of the *Power* menu in *Non Signalling* mode. The same holds for statistical measurement settings associated to the measurement control softkey and the *Marker/Display* test settings. For a detailed description of these functions refer to p. 4.9 ff.

The following softkey/hotkey combinations differ from the *Non Signalling* mode:

P/t Norm. GMSK

The *P/t Norm. GMSK* measurement control softkey controls the *P/t Norm. GMSK* measurement; see detailed explanation in section *Measurement Control* on p. 4.4. Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.27 ff.

Meas. Slot

The *Meas. Slot* hotkey defines the measured timeslot. The function of the softkey depends on the operating mode of the MS under test (see *Slot Mode* softkey in section *RF Signals of the MS (Connection Control – MS* Signal) on p. 4.133 ff.):

- When the mobile is in single-slot mode, *Meas. Slot* is disabled. The *Timeslot* set at the mobile (see *Timeslot* softkey on p. 4.92) is measured and displayed.
- When the mobile is in multislot mode, the measured timeslot is equal to the MS *Timeslot* by default, however, *Meas. Slot* can be varied to analyze the whole TDMA frame. See Fig. 4-48 on p. 4.94.

Remote control
`CONFigure:MSSignal:MCONtrol:MESLot`

Applic1
Applic 2

The *Applic1/Applic2* softkey selects the power measurement application.

The applications *P/t Normal <Mod_Type>* depend on the modulation scheme of the analyzed signal. In the *P/t Multislot* application, the modulation in each measured slot can be defined separately. The P/Frame, P/Slot Graph, and P/Slot Table menus and settings do not depend on the modulation scheme.

The *Power* measurement menu and the measurement control softkey change with the application selected; the results are explained in section *Measurement Results* on page 4.96 ff.

P/t Normal
GMSK

The *P/t Normal GMSK* hotkey selects the power versus time measurement for GMSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control
The *P/t Normal GMSK* application is selected by the keywords `[:NORMal]` `[:GMSK]` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer` `[:NORMal][:GMSK]...`

P/t Normal
8PSK

The *P/t Normal 8PSK* hotkey selects the power versus time measurement for 8PSK modulated normal burst signals (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control:
The *P/t Normal 8PSK* application is selected by the keywords `[:NORMal]:EPSK` in the 3rd and 4th level of the POWer commands, e.g. `CONFigure:POWer` `[:NORMal]:EPSK...`

P/t
Multislot

The *P/t Multislot* hotkey selects the power versus time measurement for multislot configurations (see explanation of GSM burst structure at the beginning of section *Limit lines (Power Configuration – Limit Lines)* on page 4.31).

Remote control:
The *P/t Multislot* application is selected by the 3rd level keyword `:MSLot` in the POWer commands, e.g. `CONFigure:POWer:MSLot...`

P/Frame

The *P/Frame* hotkey selects the power versus frame measurement. In this application, the average burst power in a particular timeslot is measured over a range of consecutive TDMA frames and displayed in tabular form.

Remote control
The *P/Frame* application is selected by the keyword `:FRAMe` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:FRAMe...`

P/Slot
Graph

The *P/Slot Graph* hotkey selects the power versus slot measurement with graphicaldisplay. In this application, the average burst power in all eight timeslots of a TDMA frame is measured and displayed in a bar graph.

Remote control
The *P/Slot Graph* application is selected by the keyword `:SLOT` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:SLOT...`

P/Slot Table

The *P/Slot Table* hotkey selects the power versus slot measurement with tabulardisplay. In this application, the average burst power in all eight timeslots of several consecutive TDMA frames is measured and displayed in a table.

Remote control
The *P/Slot Table* application is selected by the keyword `:XSLot` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:XSLot...`

P/PCL

The *P/PCL* hotkey selects the power versus PCL measurement. In this application, the average burst power in three GSM channels is measured as a function of the PCL of the mobile phone and displayed in tabular form.

Remote control
The *P/PCL* application is selected by the keyword `:PCL` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:PCL...`

P/t Access Burst

The *P/t Access Burst* hotkey selects the power versus time measurement of the access burst.

Note: *There is no mode where the mobile transmits access bursts in consecutive TDMA frames. As a consequence, in the* P/t Access GMSK *application, only one access burst can be measured when the mobile attempts a location update (activate the application before performing a location update). See also explanations at the beginning of section* Power Measurements *on page 4.88.*

Remote control
The *P/t Access Burst* application is selected by the keywords `:ABURst[:GMSK]` in the 3rd and 4th level of the `POWer` commands, e.g. `CONFigure:POWer:ABURst[:GMSK]...`

The following test settings depend on the application selected.

a) P/t Normal GMSK, P/t Normal 8PSK, P/t Access Burst

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path and provides the trigger settings for the Power measurement.

Difference from *Non Signalling* mode (see p. 4.9 ff):

- In *GSM400/850/900/1800/1900-MS Signalling*, the measurement is triggered by the signal from the signalling unit or the mobile phone. Use of an external trigger signal is not possible.
- In *GSM400/850/900/1800/1900-MS Signalling*, the maximum input level *(RF Max. Level)* can be set automatically according to the PCL of the mobile phone *(RF Mode* hotkey, setting *PCL*, see also *MS Signal* tab, section *Table-oriented Version* on p. 4.138 f.).

MS Signal

The *MS Signal* softkey controls the traffic channel transmitter output signal of the mobile phone. The MS output signal parameters are indicated in the *Overview Menu* (see p. 4.86). For a detailed explanation see section RF Signals of the MS (Connection Control – MS Signal) on p. 4.133 ff.

PCL

The *PCL* hotkey sets the mobile transmitter output power. This power is defined in terms of power control levels without dimension (see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.103.

PCL is available only if the mobile station is set to single slot mode (see *Slot Mode* softkey on p. 4.134). If the MS is in multislot mode, the *Slot Config.* softkey is displayed instead; see below.

Remote control
```
CONFigure:MSSignal[:CSWitched][:TCH][:SSLot]:MS:PCL
```

Slot Config.

The *Slot Config.* hotkey opens the *Slot Configuration Editor* window to determine the levels in all uplink and downlink timeslots. The *Slot Configuration Editor* is described in section *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.

Slot Config. is available only if the mobile station is set to multislot mode (see *Slot Mode* softkey on p. 4.134). If the MS is in single slot mode, the *PCL* softkey is displayed instead; see above.

Remote control
```
CONFigure:MSSignal[:CSWitched][:TCH]:MSLot:SCONFig
CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONfig
```

Channel

The *Channel* hotkey sets the MS traffic channel number. For an overview of GSM channel structure see tables in section *Control of Input and Output Signals* on page 4.66.

Remote control
```
PROCedure:SIGNalling[:CSWitched][:TCH]:CHANnel <number>
PROCedure:SIGNalling:PDATa[:TCH]:MSLot:CHANnel
```

Timeslot

The *Timeslot* hotkey sets the timeslot used for the MS traffic channel signal. The function of this softkey depends on the operating mode of the MS under test (see *Slot Mode* softkey in section *RF Signals of the MS (Connection Control – MS* Signal) on p. 4.133 ff.):

- When the mobile is in single-slot mode, the MS *Timeslot* is identical with the measured slot (see *Meas. Slot* softkey on p. 4.89). *Meas. Slot* is disabled.
- When the mobile is in multislot mode, the used *Timeslot* is equal to the measured timeslot by default, however, the measured timeslot can be changed by means of *Meas. Slot.* See Fig. 4-48 on p. 4.94.

Remote control
```
CONFigure:MSSignal:MCONtrol:MESLot
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot
PROCedure:SIGNalling:PDATa[:TCH]:MSLot:MTIMeslot
```

Timing Advance

The *Timing Advance* hotkey sets a (zero or positive) delay time correcting the MS timing. See also section *RF Signals of the MS (Connection Control – MS* Signal) on p. 4.133 ff.

Remote control
```
CONFigure:MSSignal[:CSWitched][:TCH]:TADVance
```

Traffic Mode

The *Traffic Mode* hotkey selects the speech and data coding scheme for the MS traffic channel. See section *Network Parameters (Connection Control – Network)* on page 4.147.

Remote control
```
CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic
```

Bit Stream

The *Bit Stream* hotkey selects the data to be transmitted on the traffic channel. See section *Network Parameters (Connection Control – Network)* on page 4.147.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:BITStream[?]
PROCedure:NETWork[:CSWitched]:SMODe:BITStream[?]
CONFigure:NETWork:PDATa:BITStream[?]
PROCedure:NETWork:PDATa:BITStream
```

BS Signal

The *BS Signal* softkey controls the traffic channel signal transmitted by the CMU. See also section *RF Signals of the CMU (Connection Control – BS Signal)* on p. 4.141 ff.

TCH Level

The *TCH Level* hotkey sets the level in the used timeslot of the CMU traffic channel signal.

TCH Level is available only if the mobile station is set to single slot mode (see *Slot Mode* softkey on p. 4.134). If the MS is in multislot mode, the *Slot Config.* softkey is displayed instead; see below.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot
```

Slot Config.

The *Slot Config.* hotkey opens the *Slot Configuration Editor* window to determine the levels in all uplink and downlink timeslots. The *Slot Configuration Editor* is described in section *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.

Slot Config. is available only if the mobile station is set to multislot mode (see *Slot Mode* softkey on p. 4.134). If the MS is in single slot mode, the *TCH Level* softkey is displayed instead; see above.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONFig:UUNused
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONFig:INDividual
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:SCONFig:
  UUNused
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:SCONFig:
  INDividual
CONFigure:BSSignal:PDATa[:TCH]:MSLot:SCONFig
PROCedure:SIGNalling:PDATa[:TCH]:MSLot:BS:SCONFig
```

Hopping

The *Hopping* hotkey selects the frequency hopping sequence for the CMU traffic channel signal.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:A etc.
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:FHOPping:
  SEQuence
```

b) P/t Multislot

The settings accessible via the *Application, Analyzer Level, MS Signal, and BS Signal* softkey are identical with those of application *P/t Normal GMSK*, see above. The *Marker/Display* softkey is identical with the *Marker/Display* softkey in *Non Signalling* mode.

The settings associated to the measurement control softkey are analogous to the *Non Signalling* settings. The important difference is due to the fact that in *Signalling* mode, CMU and MS under test are synchronized so that the true TDMA timing of the MS signal is known. Instead of a *Trig. Slot Offset*, the actual timeslot number *(Meas. Slot)* can be used in *Signalling* mode.

Multislot

The *Multislot* measurement control softkey controls the *P/t Multislot* measurement. Two of the hotkeys associated to the *Multislot* softkey are different from the *Non Signalling* mode:

Slot Count

The hotkey *Slot Count* defines an integer number of timeslots to be measured. The actual measured time range is larger than the integer number of slots because it comprises an additional display margin; for details see remote control command description. The *Meas. Slot* hotkey defines the position of the measurement range within the TDMA frame; see Fig. 4-48 on p. 4.94.

The display range is adapted to the *Slot Count* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys. Changing the *Slot Count* overrides the *Time Scale* settings and restores the default display range.

Remote control
`CONFigure:POWer:MSLot:SCOunt`

Meas Slot

The hotkey *Meas. Slot* determines the timeslot that is measured in all *Multislot* configurations. In the graphical display, this measured timeslot is marked by *Meas. Slot*.

- If *Slot Count* is equal to 1, then the measurement extends over the *Meas. Slot* plus an appropriate display margin.
- If *Slot Count* is equal to 2, then the timeslot preceding the *Meas. Slot (Meas. Slot –1)* and the *Meas. Slot* are measured.
- If *Slot Count* is equal to 3 (4), then *Meas. Slot – 1, Meas. Slot* and the next timeslot (the two next timeslots, *Meas. Slot + 1* and *Meas. Slot + 2)* are measured.

The beginning of the *Meas. Slot* defines the origin (symbol no. 0) of the time axis. The *Meas. Slot* is also the reference for the *Timing* measurement; it must be active to obtain valid measurement results.

The relation between the *Meas. Slot*, the *Slot Count* and the measured time range for a signal with three active timeslots is shown in Fig. 4-48 below.

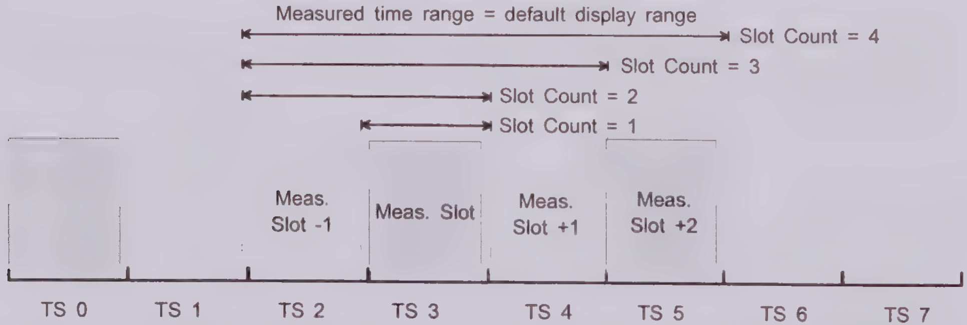


Fig. 4-48 Trigger slot offset and slot count (for Meas. Slot = 3

The display range is adapted to the *Slot Count* and *Meas. Slot* settings by default but can be modified by means of the *Display Marker – Time Scale* and *Display Marker – Default Scale* hotkeys.

Note: *The* Meas. Slot *is equal to the timeslot set at the mobile by default; see* Timeslot *softkey on p. 4.92. The current Meas. Slot setting is overwritten when the MS* Timeslot *is changed.*

Remote control
`CONFigure:MSSignal:MCONtrol:MESLot`

c) P/Frame, P/Slot Graph, P/Slot Table

The settings accessible via the measurement control softkey, the *Application, Analyzer Level, MS Signal, and BS Signal* softkey are identical with those of application *P/t Normal GMSK*, see above. The *Marker/Display* softkey is not needed.

d) P/PCL

The settings of the *Application, Analyzer Level*, and *BS Signal* softkey are identical with those of application *P/t Normal GMSK*, see above. In application P/PCL, the *P/PCL – Channel Count* and the *MS Signal* softkey are used for channel selection.

P/PCL

The *P/PCL* softkey controls the power measurement and indicates its status (RUN | HLT | OFF).

Channel Count

The *Channel Count* hotkey determines whether the P/PCL measurement is performed on 3 or 7 different GSM channels. If only 3 channels are selected, the P/PCL measurement is faster; the last four columns in the output table of the *Power* menu are suppressed.

Remote control
`CONFigure:POWer:PCL:CCOunt C3 | C7`

MS Signal

The *MS Signal* softkey defines seven channels for the P/PCL measurement.

1st Chan

The *1st Chan* hotkey defines the first GSM channel to be measured. For a list of GSM channels refer to the tables in section *Control of Input and Output Signals* (p. 4.66 ff; the analyzed channels are uplink channels).

Remote control
`CONFigure:POWer:PCL:CHANnel <Channel1>,...,<Channeln>`

The remaining hotkeys select the second up to the 7th channel, respectively.

Measurement Results

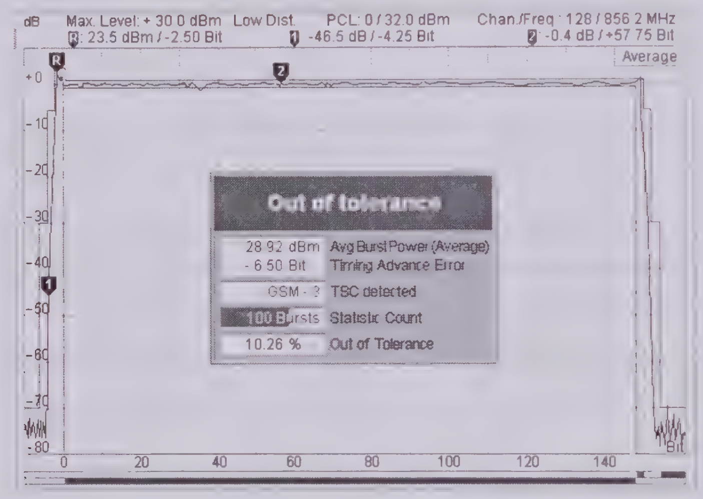
The measurement results depend on the application selected.

a) P/t Normal GMSK

The results displayed in the measurement menu *Power*, application *P/t Normal GMSK*, can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The measurement results are indicated in two parameter lines, the test diagram and an info box:


Parameter line 1 / 2

Test diagram

Info box

Max. Level: + 30.0 dBm Low Dist. PCL: 0 / 32.0 dBm Chan./Freq : 128 / 856.2 MHz

R: 23.5 dBm / -2.50 Bit 1 -46.5 dB / -4.25 Bit 2 -0.4 dB / +57.75 Bit

Out of tolerance

28.92 dBm	Avg Burst Power (Average)
- 6.50 Bit	Timing Advance Error
GSM - 3	TSC detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-49 Display of measurement results (P/t Normal GMSK menu)

Settings/ scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

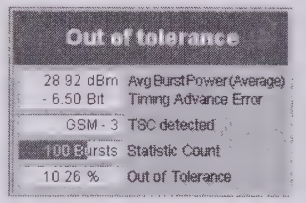
1st parameter line The first parameter line contains the following settings:

Max. Level	Maximum input level as set in *Input Level – Max. Level* (p. 4.130)
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)*
PCL	Power control level and corresponding output power of mobile
Chan./Freq	RF channel and associated frequency

2nd parameter line The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) and/or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) and/or difference from reference marker (setting *relative*)

Info box



Out of tolerance

28 92 dBm Avg Burst Power (Average)
- 6.50 Bit Timing Advance Error
GSM - 3 TSC detected
100 Bursts Statistic Count
10 26 % Out of Tolerance

The info box contains the following settings:

Statistic Count	Number of bursts per measurement cycle.

In addition, it indicates the results for the scalar measured values:

Avg. Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
Timing Adv.	Error due to timing advance in bits. This measured value replaces the setting value *Bit Offset* in *Non Signalling* mode. See also section *Measurement Results* on page 4.106.
TSC detected	Training sequence of the measured RF signal.
Out of Limit	Relative number of measured bursts that are out of the tolerances defined by the limit lines.
Burst Matching	Error message if the displayed curve is out of tolerance.

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer[:NORMal][:GMSK]?
CALCulate:POWer[:NORMal][:GMSK]:LIMit:MATChing?
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?
```

Measurement curves (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers, and the D-line, if defined. The curve is derived from 668 equidistant measurement points with a ¼ bit spacing covering a time range between –10 bit and 156 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be changed via the *Display Area* hotkey.

Remote control

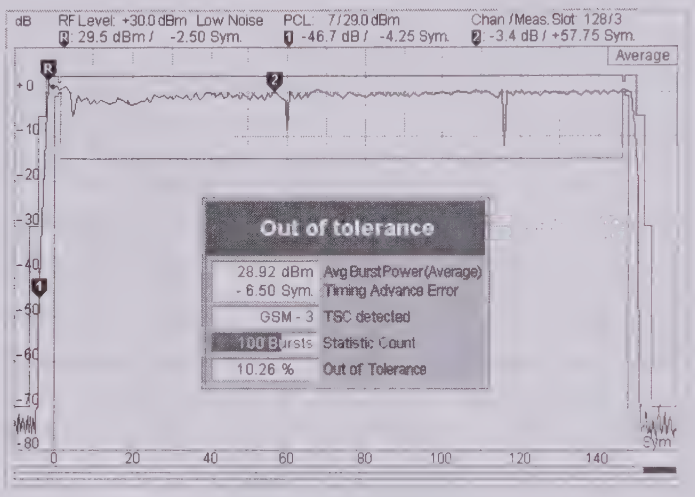
```
READ:ARRay:POWer[:NORMal][:GMSK]...?
READ:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:...?
FETCh:ARRay:POWer[:NORMal][:GMSK]...?
SAMPle:ARRay:POWer[:NORMal][:GMSK]...?
```

b) P/t Normal 8PSK

As shown in Fig. 4-50 below, the *P/t Normal 8PSK* measurement results are similar to the *P/t Normal GMSK* results. The following differences occur:

- With 8PSK modulation, the time axis is scaled in symbol periods. 8PSK symbol periods and GMSK bit periods are of equal length.
- The default limit lines differ from the GMSK limit lines.

See explanation of GSM burst structure and power/time templates in section *Limit lines (Power Configuration – Limit Lines)* on page 4.31 ff.



Parameter line 1, 2

Test diagram

Info box

RF Level: +30.0 dBm Low Noise
PCL: 7 / 29.0 dBm
Chan / Meas. Slot: 128 / 3
R: 29.5 dBm / -2.50 Sym.
1: -46.7 dB / -4.25 Sym.
2: -3.4 dB / +57.75 Sym.

Out of tolerance

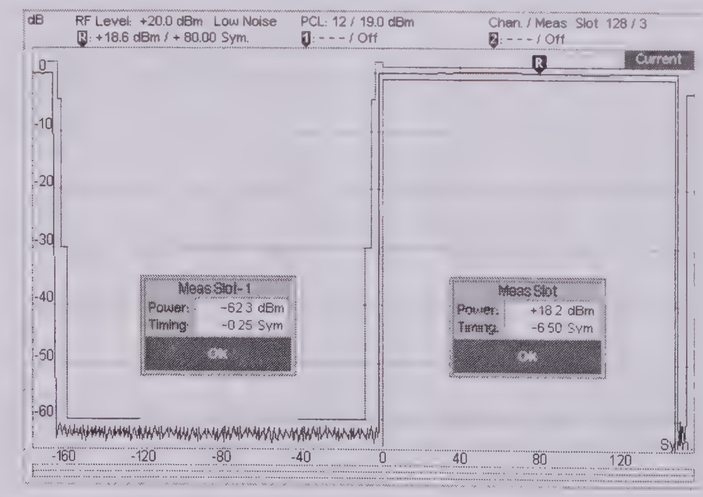
28.92 dBm Avg Burst Power (Average)
- 6.50 Sym. Timing Advance Error
GSM - 3 TSC detected
100 Bursts Statistic Count
10.26 % Out of Tolerance

Fig. 4-50 Display of results (Power – P/t Norm. 8PSK)

c) P/t Multislot

As shown in Fig. 4-51 below, the *P/t Multislot* measurement results are analogous to the corresponding *Non Signalling* mode results; see section Measurement Results on page 4.20 ff. The following differences occur:

- The first parameter line indicates the PCL of the mobile phone under test instead of the *Frequency Offset* of the RF input signal.
- The actual TDMA timeslot *(Meas. Slot)* replaces the *Trig. Slot Offset;* see section *P/t Multislot* on p. 4.93.



Parameter line 1, 2

Test diagram

Info boxes

Limit Check

RF Level: +20.0 dBm Low Noise
PCL: 12 / 19.0 dBm
Chan. / Meas Slot 128 / 3
R: +18.6 dBm / + 80.00 Sym.
1: - - - / Off
2: - - - / Off

Meas Slot - 1
Power: -62.3 dBm
Timing: -0.25 Sym

Meas Slot
Power: +18.2 dBm
Timing: -6.50 Sym

Fig. 4-51 Display of results (Power – P/t Multislot)

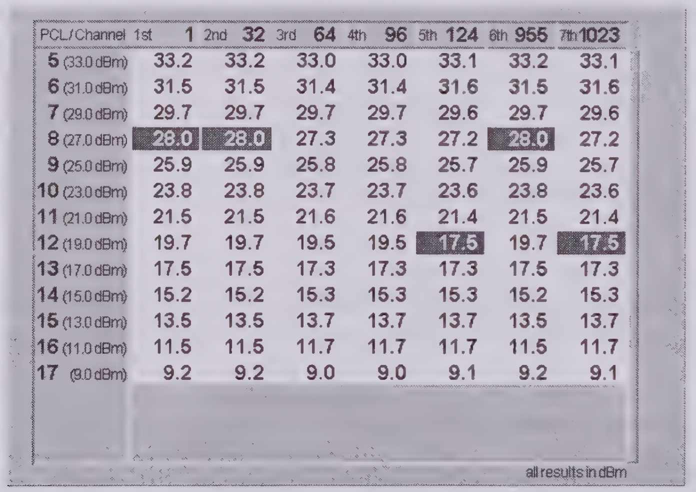
d) P/Frame, P/Slot Graph, P/Slot Table

The results displayed in the measurement menu *Power*, applications *P/Frame, P/Slot Graph,* and *P/Slot Table* are analogous to the corresponding *Non Signalling* mode results; see section Measurement Results on page 4.20 ff. In *Signalling* mode, the PCL of the mobile phone under test is indicated in the parameter line instead of the *Frequency Offset* of the RF input signal.

In *Signalling* mode, the burst timing and the numbering of the timeslots within a TDMA frame is known. Therefore, the *P/Slot Graph* menu always shows a full TDMA frame (slot 0 to 7); the first timeslot doesn't have to be determined with a trigger condition. In the *P/Slot Table* application, the first timeslot displayed corresponds to the beginning (slot 0) of a TDMA frame. In the *P/Slot Frame* application, the used timeslot in all consecutive TDMA frames is displayed.

e) P/PCL

The measurement menu *Power*, application *P/PCL,* contains a table of all measured average burst powers.



PCL/Channel	1st 1	2nd 32	3rd 64	4th 96	5th 124	6th 955	7th 1023
5 (33.0 dBm)	33.2	33.2	33.0	33.0	33.1	33.2	33.1
6 (31.0 dBm)	31.5	31.5	31.4	31.4	31.6	31.5	31.6
7 (29.0 dBm)	29.7	29.7	29.7	29.7	29.6	29.7	29.6
8 (27.0 dBm)	28.0	28.0	27.3	27.3	27.2	28.0	27.2
9 (25.0 dBm)	25.9	25.9	25.8	25.8	25.7	25.9	25.7
10 (23.0 dBm)	23.8	23.8	23.7	23.7	23.6	23.8	23.6
11 (21.0 dBm)	21.5	21.5	21.6	21.6	21.4	21.5	21.4
12 (19.0 dBm)	19.7	19.7	19.5	19.5	17.5	19.7	17.5
13 (17.0 dBm)	17.5	17.5	17.3	17.3	17.3	17.5	17.3
14 (15.0 dBm)	15.2	15.2	15.3	15.3	15.3	15.2	15.3
15 (13.0 dBm)	13.5	13.5	13.7	13.7	13.7	13.5	13.7
16 (11.0 dBm)	11.5	11.5	11.7	11.7	11.7	11.5	11.7
17 (9.0 dBm)	9.2	9.2	9.0	9.0	9.1	9.2	9.1

all results in dBm

Fig. 4-52 Display of measurement results (P/PCL menu)

PCL/Channel The *PCL/Channel* table contains the average burst power for all PCLs supported by the mobile, starting with the maximum output power (lowest PCL) and in the three or seven channels selected via the *Channel* softkey. If the tolerance value defined in the *Limits* card of the *Power Configuration* menu (see section *Limit Lines (Power Configuration – Limit Lines)* on p. 4.103 ff) is violated, the result is shown on a red background.

If more than 16 different PCLs are supported, the table contains a scrollbar.

Remote control

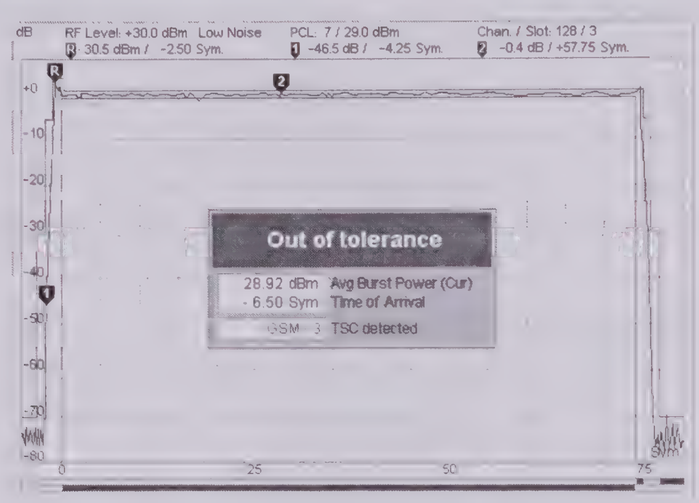
```
READ[:SCALar]:POWer:PCL?
CALCulate:POWer:PCL:LIMit:MATChing?
FETCh[:SCALar]:POWer:PCL?
SAMPle[:SCALar]:POWer:PCL?
```

f) P/t Access Burst

The results displayed in the measurement menu *Power*, application *P/t Access Burst,* can be divided into three groups:

- Settings
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The measurement results are indicated in two parameter lines, the test diagram and an info box:


Parameter line 1 / 2

Test diagram

Info box

RF Level: +30.0 dBm Low Noise PCL: 7 / 29.0 dBm Chan. / Slot: 128 / 3

R 30.5 dBm / -2.50 Sym. 1 -46.5 dB / -4.25 Sym. 2 -0.4 dB / +57.75 Sym.

Out of tolerance

28.92 dBm Avg Burst Power (Cur)

- 6.50 Sym Time of Arrival

GSM 3 TSC detected

Fig. 4-53 Display of measurement results (P/t Access Burst menu)

Settings/ scalar results	Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

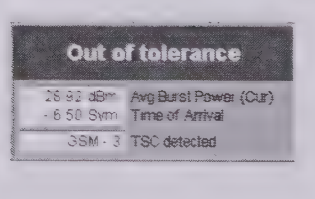
1st parameter line — The first parameter line contains the following settings:

RF Level	Maximum input level as set in *Input Level – Max. Level* (p. 4.130)
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)*
PCL	Power control level and corresponding output power of mobile
Chan./Slot	RF channel and timeslot number

2nd parameter line — The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) and/or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) and/or difference from reference marker (setting *relative*)

Info box


Out of tolerance

28.92 dBm Avg Burst Power (Cur)

- 6.50 Sym Time of Arrival

GSM - 3 TSC detected

The info box indicates the results for the scalar measured values:

Avg. Burst Power	Average burst power, depending on the display mode set (see upper right corner of the diagram).
Time of Arrival	Time offset (in symbol periods) between the expected and the measured timing of the current burst from the mobile. Like in a real GSM network, the timing advance of the mobile is assumed to be unknown and the expected timing is in line with the timing of the BS signal. See also definition of the *Timing Advance Error* in section *Measurement Results* on page 4.106.
TSC detected	Training sequence of the measured RF signal.

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:ABURst[:GMSK]?
CALCulate:POWer:ABURst[:GMSK]:LIMit:MATChing?
FETCh[:SCALar]:POWer:ABURst[:GMSK]?
SAMPle[:SCALar]:POWer:ABURst[:GMSK]?
```

Measurement curves (arrays)

The measurement result is displayed as a continuous measurement curve in the test diagram together with the limit lines, markers, and the D-line, if defined. The curve is derived from 428 equidistant measurement points with a ¼ spacing covering a time range between –10 bit and 96 ¾ bit.

The measurement curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in bits). The displayed result depends on the test settings. The display mode for the measurement curve *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be changed via the *Display Area* hotkey.

Remote control

```
READ:ARRay:POWer:ABURst[:GMSK]...?
READ:ARRay:POWer:ABURst[:GMSK]:LIMit:MATChing:...?
FETCh:ARRay:POWer:ABURst[:GMSK]...?
SAMPle:ARRay:POWer:ABURst[:GMSK]...?
```

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains three tabs to determine the parameters controlling the power measurement including the tolerance limits.

The popup menu *Power Configuration* is activated by pressing the measurement control softkey at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The *Control* tab controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement (for burst power vs. time measurements only)
- The type of measurement curve displayed *(Display Mode,* for burst power vs. time measurements only)
- The number of bursts/evaluation periods forming a statistics cycle (for burst power vs. time measurements only)
- The averaging prescription to obtain the reference power *(Ref. Power Mode*, for *8PSK* measurements only)
- The *Timing Offset*, the expected modulation *(Modulation View)*, the number of slots measured *(Slot Count)* and the *Info Box* in the *P/t Multislot* application
- The number of timeslots measured *(Slot Count)* in the *P/Slot Table* application
- The number of RF channels measured and their GSM channel numbers *(Channel Count, Meas. Channels*, for *P/PCL* measurements only)

Besides, it influences the power display by adding or removing the *Grid.*

All settings can be defined separately for the individual applications *P/t Normal GMSK, P/t Normal 8PSK, P/t Multislot, P/Frame, P/Slot Graph, P/Slot Table,* and *P/PCL.* They are described in the section *GSM400/850/900/1800/1900-MS Non Signalling* on page 4.27 ff. The setting of the P/PCL channels is analogous to the setting via the *Channel* softkey; see section *P/PCL* on page 4.95.

Note: *There is no mode where the mobile transmits access bursts in consecutive TDMA frames. As a consequence, in the* P/t Access GMSK *application, only one access burst can be measured (single shot mode) when the mobile attempts a location update (activate the application before performing a location update). See also explanations at the beginning of section* Power Measurements *on page 4.88.*

Limit Lines (Power Configuration – Limit Lines)

The *Limit Lines* tab defines the limit lines for the burst analysis (applications *P/t Normal GMSK* and *P/t Access Burst*). Limit lines are a graphical tool for defining and monitoring tolerance values. The tab enables

- An overview of the default limit lines and areas *(Area Info)*
- Definition of the limit lines for the normal bursts section by section *(Upper Limit Line/Lower Limit Line*

The functions of this menu are described in the section *GSM400/850/900/1800/1900-MS Non Signalling* on page 4.31 ff. In contrast to the *Non Signalling* mode, the *dynamic limit line correction* depends on the actual PCL of the mobile phone. No auxiliary parameter like the fictitious *Template PCL* is defined.

The limit lines for access bursts are defined in analogy to the limit lines for normal bursts. In the remote control commands, the keyword `[:NORMal]` is to be replaced by `:ABURst`.

Limit Values for Average Burst Power (Power Configuration – Limits)

The *Limits* tab defines tolerance limits for the average burst power depending on the power control level of the mobile phone *(PCL)*. The limits apply to all applications of the *Power* menu providing a limit check (not to *P/Frame, P/Slot Graph* and *P/Slot Table)*.

GSM mobile phones are divided into different power classes according to their maximum output power:

Table 4-6 GSM Power classes

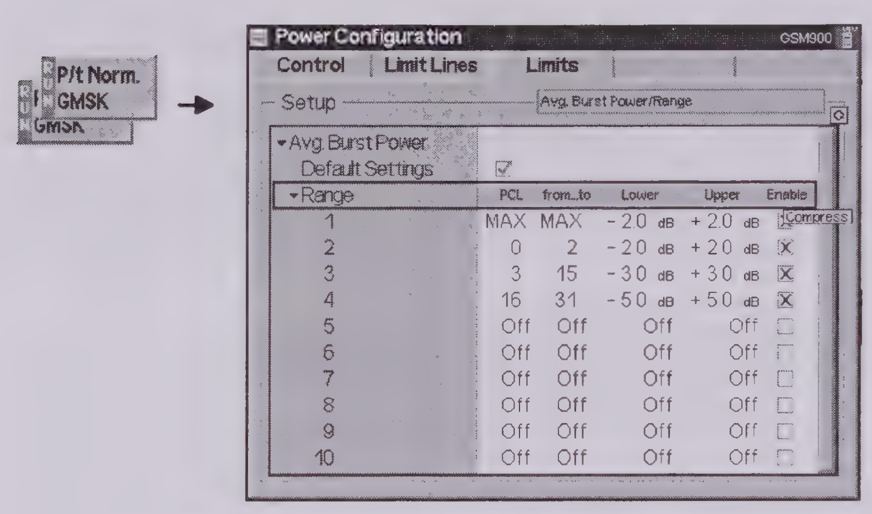
Power class	Nominal maximum output power in dBm		
	GSM400 GSM850 GSM900	GSM1800	GSM1900
1	–	30	30
2	39	24	24
3	37	36	33
4	33		
5	29		

Besides, a dimensionless scale of power control levels *(PCL)* is determined for dynamic control of the mobile power:

Table 4-7 GSM Power control levels (PCL)

Power control level, PCL	Nominal output power in dBm		
	GSM400/ GSM850/ GSM900	GSM1800	GSM1900
0	39	30	30
1	39	28	28
2	39	26	26
3	37	24	24
4	35	22	22
5	33	20	20
6	31	18	18
7	29	16	16
8	27	14	14
9	25	12	12
10	23	10	10
11	21	8	8
12	19	6	6
13	17	4	4
14	15	2	2
15	13	0	0
16	11	0	0
17	9	0	0
18	7	0	0
19 - 28	5	0	0
29	5	36	36
30	5	34	33
31	5	32	32
	PCL 16 to 31 for phase 2 only	PCL 11 to 15, 29 to 31 for phase 2 only	PCL 11 to 15, 29 to 31 for phase 2 only

Besides, tolerance values are specified for all output powers under various conditions. Power control permits to force the mobile power below the maximum value corresponding to its power class.



Setup: Avg. Burst Power/Range

Avg. Burst Power

Default Settings ☑

Range	PCL	from...to	Lower	Upper	Enable
1	MAX	MAX	-2.0 dB	+2.0 dB	☒
2	0	2	-20 dB	+20 dB	☒
3	3	15	-30 dB	+30 dB	☒
4	16	31	-50 dB	+50 dB	☒
5	Off	Off	Off	Off	☐
6	Off	Off	Off	Off	☐
7	Off	Off	Off	Off	☐
8	Off	Off	Off	Off	☐
9	Off	Off	Off	Off	☐
10	Off	Off	Off	Off	☐

Fig. 4-54 Power Configuration – Limits

Default Settings The *Default Settings* switch overwrites all settings of the *Limits* tab with default values.

Average Burst Power The table *Average Burst Power* defines a tolerance band for the average burst power. Matching of the tolerances is checked for each burst measured.

The limit values are defined relative to the nominal output power corresponding to the mobile's power control level (see Table 4-7). An upper and lower limit can be defined for up to 10 arbitrary, continuous ranges of PCLs. In contrast to the modulation measurement, these power limits may also be asymmetrical (i.e. not of the same magnitude). The table contains the following columns:

Range	Current range number
PCL:from	Initial PCL in the range 0 to 31, MAX
... to	Final PCL in the range (greater or equal to the initial PCL)
Lower	Lower level limit relative to nominal output power
Upper	Upper level limit relative to nominal output power
Enable	Enable (box checked) or disable the limit check in the current range

If the initial PCL coincides with the final PCL, the range consists of one power control level only. Unused ranges are marked by the entries *Off*. The entry *MAX* refers to the maximum PCL of the mobile phone according to its power class.

Remote control

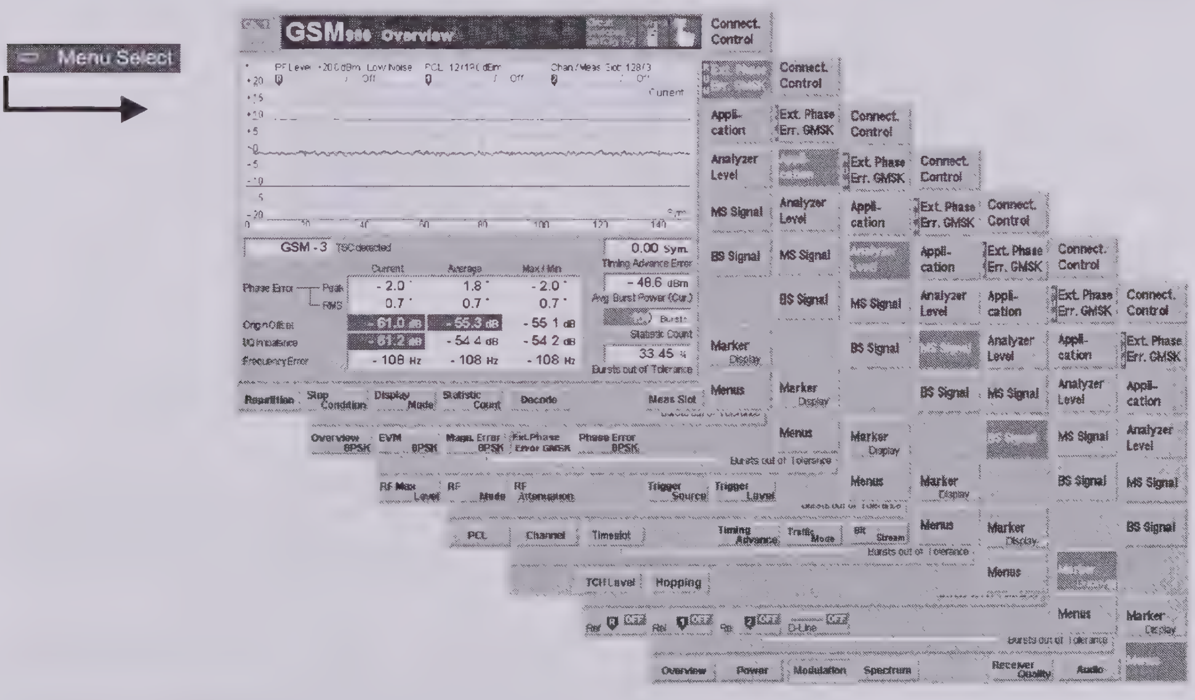
```
CONFigure:Power[:NORMal][:GMSK]:LIMit:ABPower<nr>[:ENABle] ON
| OFF
CONFigure:Power[:NORMal][:GMSK]:LIMit:ABPower<nr>
         <StartPCL>,<StopPCL>,<LowerLimit>,<UpperLimit>
```

Modulation Measurements

The menu group *Modulation* contains the functions for measurement of the modulation parameters of the RF signal transmitted by the mobile phone. The popup menu *Modulation Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Modulation*.

Apart from few exceptions, the menu group *Modulation* does not differ from its corresponding menu group in the measurement mode *GSM400/850/900/1800/1900-MS Non Signalling* (see p. 4.37 ff.):

1. In addition to the maximum input level, the attenuation and the RF channel, the first parameter line also contains the power control level (PCL) of the mobile. The PCL can be set via the *PCL/Channel* softkey and can be used to define the input level *(Input Level* softkey).
2. The trigger sources *Signalling, Free Run, RF Power,* and *IF Power* are available. This means that the measurement is triggered by the signal from the CMU's signalling unit or the mobile phone; triggering by an additional external signal (parameter *External)* is not possible.



		Current	Average	Max / Min
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

0.00 Sym. Timing Advance Error

- 48.6 dBm Avg. Burst Power (Cur.)

Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-55 Measurement menu Modulation

Test Settings

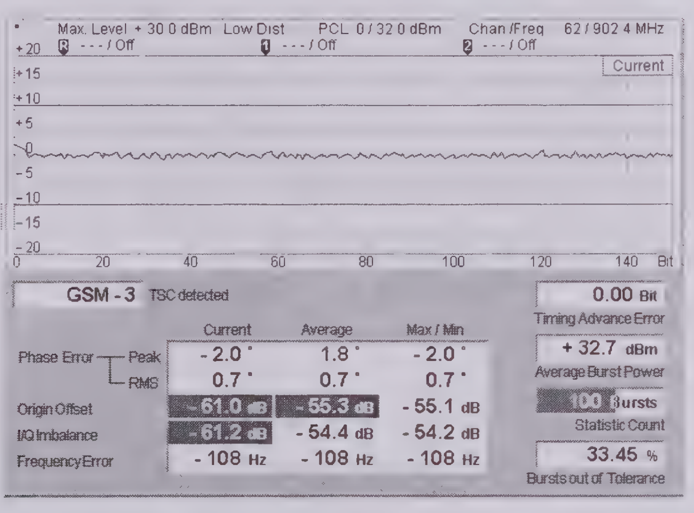
The selections and test settings provided by the *Ext. Phase Err. GMSK, Analyzer Level,* and Marker/Display softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.38 ff). The *MS Signal* and *BS Signal* softkeys and the *Meas. Slot* hotkey are equal to the softkeys of the same name in the *Power* menu (see page 4.89 ff).

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (the measurement curve plotted as a function of time)

The values are indicated in two parameter lines, the test diagram and a tabular overview below:



Parameter line 1 | 2

Test diagram

Output table

Max. Level + 30 0 dBm Low Dist PCL 0 / 32 0 dBm Chan /Freq 62 / 902 4 MHz

R ---/Off 1 ---/Off 2 ---/Off

GSM - 3 TSC detected

		Current	Average	Max / Min
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

Timing Advance Error: 0.00 Bit

Average Burst Power: + 32.7 dBm

Statistic Count: 100 Bursts

Bursts out of Tolerance: 33.45 %

Fig. 4-56 Display of results (modulation menu)

In contrast to the *Non Signalling* mode (see p. 4.40 ff.) the first parameter line contains also the PCL of the mobile station, and the *Timing Advance Error* is indicated. Besides the representation and interpretation of the results are identical.

Timing Advance Error The *Timing Advance Error* output field, which is displayed in the right-hand output field of the *Modulation* measurement menu, indicates the time offset (in symbol periods) between the expected and the measured timing of the current burst. The expected timing results from the timing of the BS signal and the (known) timing advance of the mobile station.

The *Timing Advance Error* can be determined with trigger mode *Signalling* only; see *MS Signal* tab, section *Table-oriented Version* on p. 4.138 f.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains two tabs which define the parameters of the phase and frequency error measurement including the error tolerances.

The popup menu *Modulation Configuration* is activated by pressing the softkey *Phase/Err. GMSK* in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Modulation Configuration* menus are described in section *GSM400/850/900/1800/1900-MS Non Signalling*, see p. 4.49 ff.

Spectrum Measurements

The menu group *Spectrum* contains the functions for measurement of the off-carrier power, which is due to the modulation and the bursty nature of the RF signal. The popup menu *Spectrum Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menus *Spectrum*.

Apart from few exceptions, the menu group *Spectrum* does not differ from its corresponding menu group in the measurement mode *GSM400/850/900/1800/1900-MS Non Signalling* (see p. 4.37 ff.):

1. In addition to the maximum input level, the attenuation, and the RF channel, the first parameter line also indicates the timeslot number of the base station signal. The PCL can be set via the *PCL/Channel* softkey and can be used to define the input level *(Input Level* softkey).
2. The trigger sources *Signalling, Free Run, RF Power,* and *IF Power* are available. This means that the measurement is triggered by the signal from the CMU's signalling unit or the mobile phone; triggering by an additional external signal (parameter *External)* is not possible.

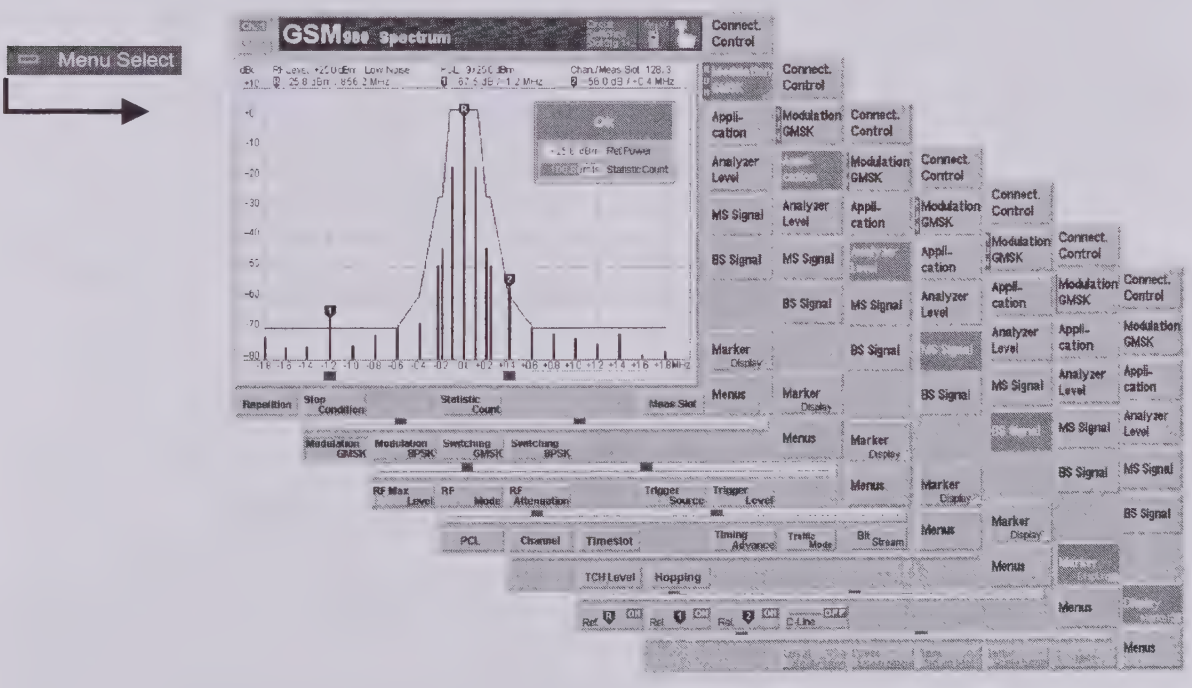


Fig. 4-57 Measurement menu Spectrum (application Modulation GMSK)

Test Settings

The selections and test settings provided by the *Modulation GMSK, Analyzer Level,* and Marker/Display softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.38 ff). The *MS Signal* and *BS Signal* softkeys and the *Meas. Slot* hotkey are equal to the softkeys of the same name in the *Power* menu (see page 4.89 ff).

Measurement Results

The *Spectrum* measurement menu and the results depend on the type of spectrum (application *Modulation GMSK* or *Switching GMSK*) selected.

In contrast to the *Non Signalling* mode (see p. 4.40 ff.) the first parameter line also contains the PCL of the mobile. Besides, the interpretation of the results is identical.

Measurement Configurations (Spectrum Configuration)

The popup menu *Spectrum Configuration* contains three tabs which define the parameters of the spectrum measurement including the error tolerances.

The popup menu *Spectrum Configuration* is activated by pressing the measurement control softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *Modulation GMSK* or *Switching GMSK*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Spectrum Configuration* menu are described in section *GSM400/850/900/1800/1900-MS Non Signalling*, see p. 4.49 ff.

Receiver Quality Measurements

The menu group *Receiver Quality* measures parameters which characterize the quality of transmission on the complete transmission path from the CMU to the device under test (mobile station) and back. In particular, assuming that transmitter errors do not occur, this allows to assess the sensitivity of the mobile station receiver at low RF power levels.

The popup menu *Receiver Quality Configuration* is used for configuration of the measurements; the measurement results are directly indicated in the main menu *Receiver Quality*.

The measurements in the menu group *Receiver Quality* assume that a call has been set up (signalling state *Call Established)*. This is why they are not available in the mode *GSM400/850/900/1800/1900-MS Non Signalling*.

Principle of the measurement

The Receiver Quality measurement is based on the comparison of the output signal sent by the CMU with the signal received and decoded by the device under test (mobile station).

To this end, the mobile station must return the received signal to the CMU in loop back mode. In most cases, a test SIM card is required for this purpose.

Because of the higher signal level, the transmission errors produced on the way back (from the mobile station to the CMU) can usually be neglected. However, frames destroyed on the way back are detected in a cyclic redundancy check (CRC) and counted. They are not taken into account in the calculation of transmission errors.

The quality of the mobile station transmitter can be tested separately in the *Modulation* measurement.

Bit classes

In the GSM system, the speech coder combines the speech information into data blocks with a length of 260 bits, the so-called frames. Within one frame, the bits are divided into bit classes:

- The 78 *class II bits* have no error protection which is why they quickly produce transmission errors.
- The 132 *class Ib bits* are partly protected against errors during channel coding (by added guard bits).

The 50 most important *class Ia bits* are well protected. The mobile phone recognizes erroneous *class Ia bits* and clears the complete frame if no correction is possible

Definition of measured quantities

The Bit Error Rate *(BER)* is the ratio of erroneous bits to the total number of transferred bits in percent (also referred to as samples in the operating mode *BER*). The CMU outputs the bit error rate according to bit classes:

BER = Erroneous bits / total number of bits * 100%
BER II = Erroneous class II bits / total number of class II bits * 100%
BER Ib = Erroneous class Ib bits / total number of class Ib bits * 100%

The Frame Erasure Rate *(FER)* is the ratio of frames recognized to be erroneous and erased by the mobile to the total number of transferred frames in percent:

FER = Erroneous frames / total number of frames * 100%

The Residual Bit Error Rate *(RBER)* characterizes the quality of transmission of the valid frames (not erased, therefore residual). It corresponds to the ratio of the erroneous bits to the total number of transferred bits in percent, the numerator and denominator referring only to the **valid frame** *(residual frames, RF)*:

RBER II = Erroneous class II bits (RF) / total number of class II bits (RF) * 100%
RBER Ib = Erroneous class Ib bits (RF) / total number of class Ib bits (RF) * 100%

The Data Block Error Rate (DBLER) is the ratio of data blocks that contain bit errors in their data field to the total number of transferred blocks in percent:

DBLER = Blocks with erroneous data fields / total number of blocks * 100%

The USF Block Error Rate (USF BLER) is the ratio of GPRS packet data blocks that contain bit errors in their Uplink State Flag (USF) to the total number of transferred blocks in percent:

USF BLER = Erroneous blocks / total number of blocks * 100%

BER/DBLER mode

The BER/DBLER measurement assesses the receiver quality for packet data traffic channels (PDTCHs) both in circuit switched or packet data mode. For a detailed explanation of this mode see section *BER Tests of PDTCHs* on p. 4.111 f.

Note: *For circuit switched channels, the reduced signalling scheme must be selected (*Signalling Channel = NONE, *see p. 4.151) and one of the packet data coding schemes CS1 to CS4 or MCS1 to MCS9 must be used (see* Traffic Mode *softkey 4.148).*

Packet switched data channels (GPRS channels) can be analyzed with option CMU-K42.

Burst by Burst mode (fast BER)

In the *Burst by Burst* mode, the CMU transmits only bits without error protection (class II bits); no guard bits are used. The internal test loop of the MS is closed before any channel decoding/encoding (see GSM 04.14 and Fig. 4-58 below), so the bit error rate is evaluated on a burst by burst basis. This increases the number of bits measured per unit of time and thus considerably enhances the measurement speed.

Note: *The* Burst by Burst *bit error rate test is specified for GSM phase II and phase II+ mobiles. Not all mobiles support this test mode. If a mobile does not support the* Burst by Burst *bit error rate test, the measurement fails (like for very low signal levels) and an error message is generated:*

Too many errors. Measurement halted !

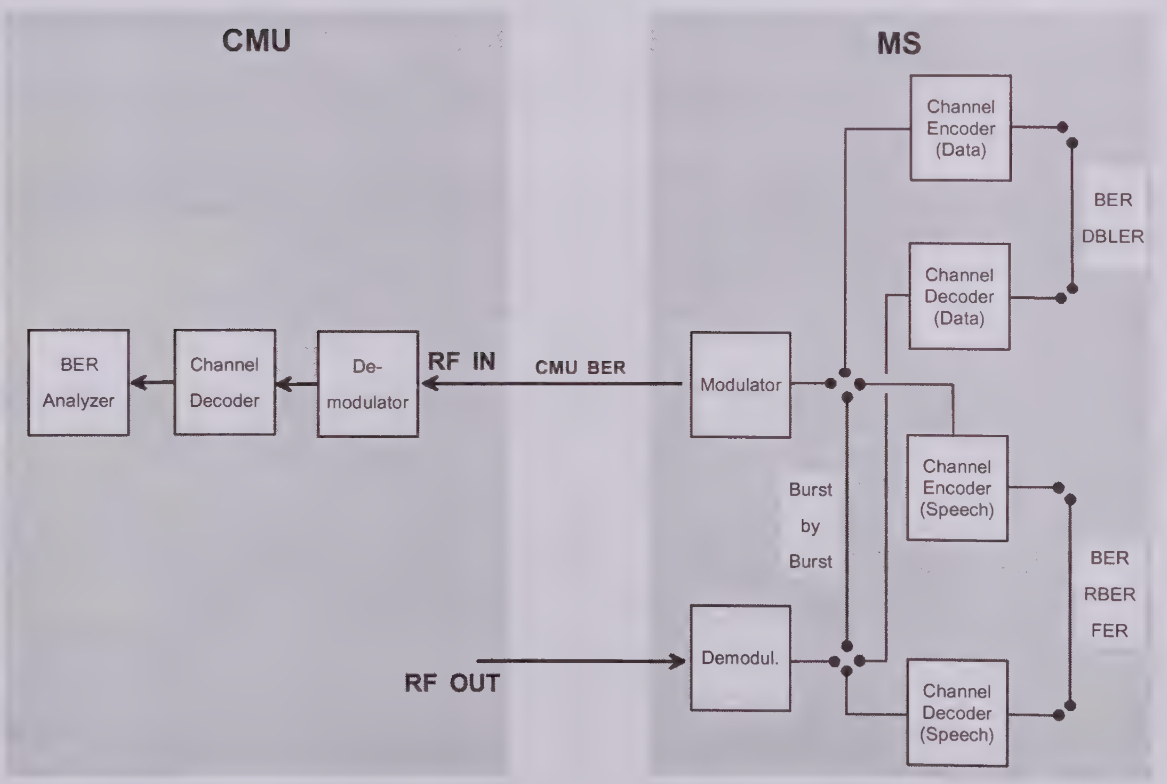


Fig. 4-58 Signal paths for BER measurements

Measured Timeslot

In contrast to TX tests, no distinction is made between the *Main Timeslot* that is used for signalling and the *Meas. Timeslot*. All *Receiver Quality* measurements are performed on the *Main Timeslot* selected via the *MS Signal – Main Timeslot* hotkey.

BER Tests of PDTCHs

For packet switched data traffic channels (PDTCHs), the bit error rate test is modified in such a way that the MS loops back the received data packets on a block by block basis and the CMU measures the BER and the Data Block Error Rate (DBLER). The *Coding Scheme* of the PDTCHs (CS1 to CS4; in circuit-switched mode and reduced signalling also MCS1 to MCS9) can be selected in the *Network* tabs of the *Connection Control* menu.

The test setup is the same as for Receiver Quality tests on circuit switched speech or data channels: The test is performed on the traffic channel with a connection between the CMU and the mobile station, i.e. the CMU must be in the *Call Established* or in the *TBF Established* state. An overview of the different test settings for the DBLER measurement on circuit switched and packet switched channels is given in the table below.

Table 4-8 DBLER measurement settings

Main Service	Traffic Mode / Coding Scheme	CMU Signalling State	Signalling Channel / Service Selection	Receiver Quality Meas. Mode
Circuit Switched (GSM)	CS1 to CS4 MCS1 to MCS9	Call Established	NONE (analogous to Reduced Signalling, setup via ext. test interface)	BER/DBLER (CMU setting)
Packet Data (Option CMU-K42)	CS1 to CS4	TBF Established	Reduced Signalling (setup via external test interface) or Test Mode B (full signalling via RF connection)	BER/DBLER (automatic selection by CMU)

Principle of the measurement

Like any other *Receiver Quality* measurement, the PDTCH BER test is based on the comparison of the output signal generated by the CMU with the signal received and decoded by the device under test (mobile station). To this end, the mobile station is set to return the received signal to the CMU in loop back mode. In the case of packet data channels, the MS loops back the packet data after demodulation and channel decoding (see BER/DBLER loop in Fig. 4-62 on p. 4.117).

Frame structure

The CMU provides a GPRS or EGPRS signal with a 52-multiframe structure as shown in Figure 4-59 below. Each 52-multiframe contains 12 blocks of 4 consecutive frames (B0 to B12), 2 idle frames (X) and 2 frames used for the Packet Timing Advance Control Channel (X). All blocks in the signal are coded and modulated with the same coding and puncturing scheme.

The mobile station returns the data bits of the received blocks using the coding and puncturing scheme signalled via RF connection (GPRS Test Mode B) or set via an external test interface (reduced signalling). This means that the loopback is done on a block by block basis. The modulation and coding schemes MCS7, MCS8 and MCS9 carry 2 RLC/MAC frames which are coded separately.

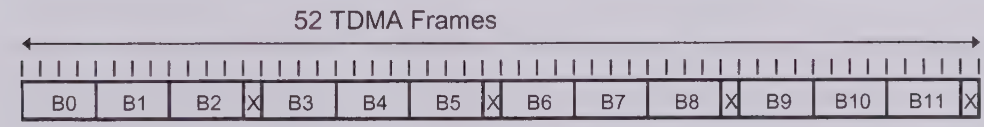


Figure 4-59: 52-multiframe for PDCH

Block structure

Each GPRS/EGPRS radio block is divided into the header information including the Uplink State Flag (USF) and the data bits. The CMU uses downlink header with fixed (circuit switched) or configurable (packet-data) USF and ignores the uplink header received from the MS. This means that only the data bits of a radio block contribute to the BER and DBLER calculation. However, in packet-data mode, where the USF can be explicitly set, the CMU is also capable of evaluating the relative number of blocks with a USF correctly received by the MS under test. This ratio is referred to as USF BLER.

On the other hand, the MS returns the received data even if the block check sequence indicates that the block was not decoded correctly. In this case the MS calculates a new block check sequence for the received data. The same timeslot is used for downlink and uplink, however, the uplink signal is delayed by 3 timeslot periods.

Definition of measured quantities

The Bit Error Rate *(BER)* is the ratio of erroneous data bits to the total number of transferred data bits in percent.

BER = Erroneous data bits / total number of data bits * 100%

The Data Block Error Rate *(DBLER)* is the ratio of blocks that contain bit errors in their data field to the total number of transferred blocks in percent:

DBLER = Blocks with erroneous data field / total number of blocks * 100%

This Data Block Error Rate is not exactly the BLER that is defined in the GSM recommendations (GSM 11.10), because the possibility of an error in the header is not taken into account. But if the probability for an error in the data field, which depends on the used coding scheme, is much higher than the probability for an error in the header, then the calculated Data Block Error Rate is a good approximation to the BLER.

Difference between DBLER and BLER

The difference between the BLER defined in GSM 11.10 and the DBLER measured by the CMU varies from one coding scheme to another. For coding scheme CS-4, where no additional effects due to channel coding occur, the difference is determined by the difference of the data field size compared to the complete RLC block size. For other coding schemes, there are additional effects originating from the different channel coding of the header and data fields and from differences in the bit error rate of header and data bits after the channel decoder. A comparison of the two coding schemes CS-4 and CS-1 is shown in Figure 4- below.

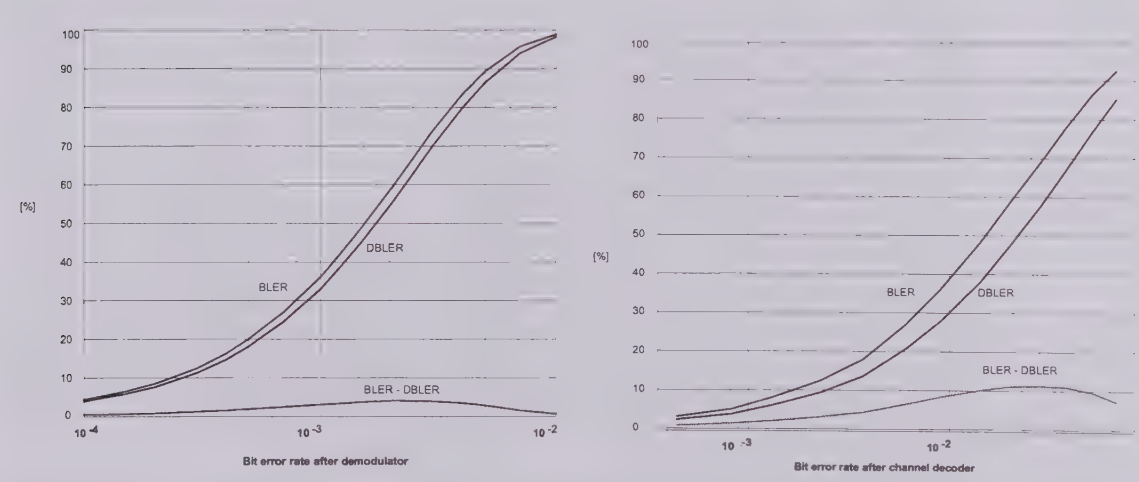


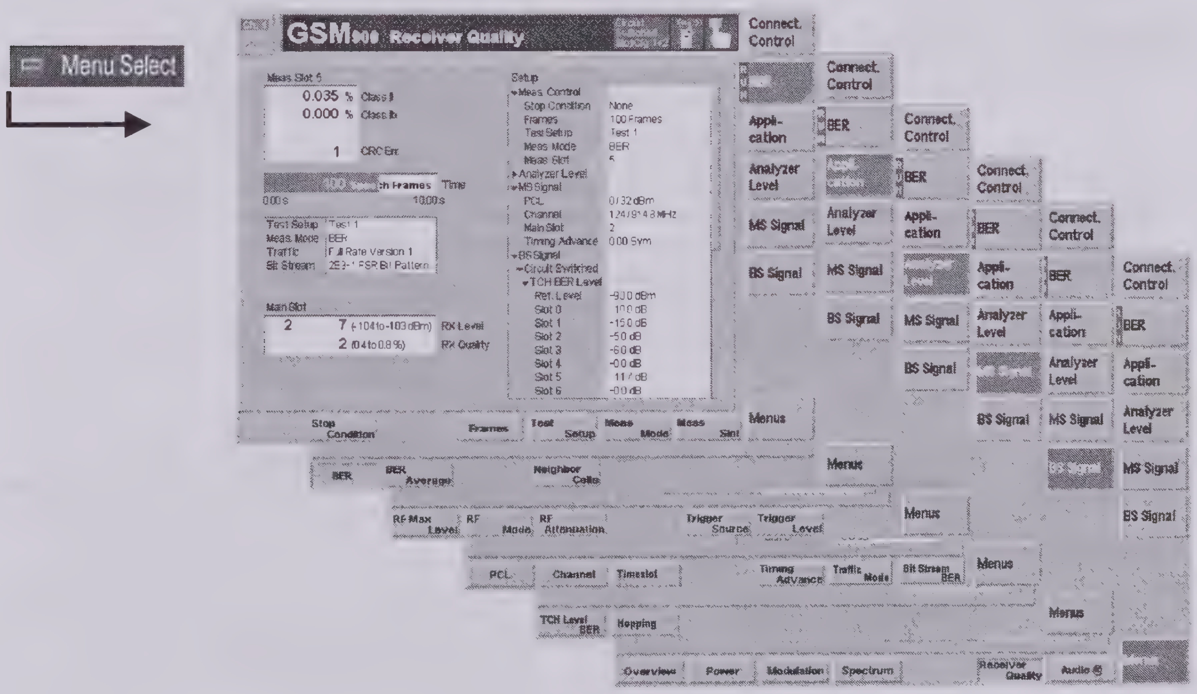
Figure 4-60: Comparison between BLER and DBLER: CS-4 (left diagram) and CS-1

Main Menu (Receiver Quality)

The main menu *Receiver Quality* shows the results and the most important parameters of the *Receiver Quality* measurement.

- The measurement control softkey *BER* (which changes to *BER Average* or *Neighor Cell* if one of these applications is selected) controls the *Receiver Quality* measurement, indicates its status *(RUN, HLT, OFF)* and opens the configuration menu *Receiver Quality Configuration*. The hotkeys associated to the measurement control softkey define the scope of the measurement.
- The softkeys *Application, Analyzer Level, MS Signal, BS Signal,* and *Menus* on the right softkey bar are combined with various hotkeys. When a softkey is selected and an associated hotkey pressed, a popup window appears which indicates a setting or enables an entry.
- In the tables in the center of the menu, the test settings of the current *Receiver Quality* measurement and the results are displayed.

The measurement menu *Receiver Quality* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or from the menu group *GSM400/850/900/1800/1900-MS Signalling* using the hotkey *Receiver Quality*.



Meas. Slot 5
0.035 % Class II
0.000 % Class Ib
1 CRC Err.
Frames Time
0.00 s 10.00 s

Test Setup: Test 1
Meas. Mode: BER
Traffic: Full Rate Version 1
Bit Stream: 2E9-1 PSR Bit Pattern

Main Slot
2 7 (-104 to -103 dBm) RX Level
2 (0.4 to 0.8 %) RX Quality

Setup
Meas. Control
Stop Condition: None
Frames: 100 Frames
Test Setup: Test 1
Meas. Mode: BER
Meas. Slot: 5
Analyzer Level
MS Signal
PCL: 0 / 32 dBm
Channel: 124 / 914.8 MHz
Main Slot: 2
Timing Advance: 0.00 Sym
BS Signal
Circuit Switched
TCH BER Level
Ref. Level: -90.0 dBm
Slot 0: 10.0 dB
Slot 1: -15.0 dB
Slot 2: -5.0 dB
Slot 3: -6.0 dB
Slot 4: -0.0 dB
Slot 5: 11.7 dB
Slot 6: -0.0 dB

Fig. 4-61 Main menu Receiver Quality (BER)

Test Settings

The *Analyzer Level* and *Menus* test settings and most of the *MS Signal* and *BS Signal* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.89). The following softkey/hotkey combinations differ from the *Power* measurement:

BER

The *BER* softkey controls the receiver quality measurement in the BER application and indicates its status (RUN | HLT | OFF).

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Receiver Quality* measurement, however, a running measurement is restarted.

Remote control

```
INITiate:RXQuality:BER
ABORt:RXQuality:BER
STOP:RXQuality:BER
CONTinue:RXQuality:BER
```

Measurement configuration

Pressing the *BER* softkey twice opens the popup menu *Receiver Quality Configuration* (see section *Measurement Configurations (Receiver Quality Configuration)* on page 4.119 ff). Besides, the following hotkeys defining the scope of the measurement are associated to the *BER* softkey:

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *1st Limit Exceeded* or *All Limits Exceeded;* see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120)

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition
                                        <StopCondition>,<Stepmode>
```

Frames

The hotkey *Frames* determines the number of frames to be sent in a *BER* measurement. It is not available in the *BER Average* and *Neighbor Cell* applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol  <Mode>,<FramesToSend>
```

Average

The hotkey *Average* determines the number of frames to be averaged in a *BER Average* measurement. It is not available in the *BER* and *Neighbor Cell* applications; see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120.

Remote control

```
CONFigure:RXQuality:BAVerage:CONTrol  <Mode>,<FramesToSend>
```

Test Setup

The *Test Setup* hotkey selects one of a maximum of ten test setups. Test setups are BER configuration files defined in the *Receiver Quality Configuration* menu (see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120). The hotkey is not available in *BER Average* mode.

Remote control
`CONFigure:RXQuality:BER:TSETup <TestSetup>`

The test setup number is denoted by a numeric suffix in the BER commands `(...RXQuality:BER<nr>:...)`.

Meas. Mode

The *Meas. Mode* hotkey selects the quantities to be measured. For a list of measurement modes and corresponding measurement results see section *Measurement Results* on page 4.116 ff.

Remote control
`CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>`

Application

The *Application* softkey selects the *application, test setup*, and the *measurement mode*. The three alternative applications *BER, BER Average*, and *Neighbor Cells* are displayed in separate measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for both applications, however, are listed in a common popup-menu (see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.119 ff).

BER and *BER Average* (=Continuous) are treated as repetition modes in other measurement groups. The difference in the *Receiver Quality* measurement is that the basic evaluation period is a speech frame instead of a single burst.

BER

The *BER* hotkey selects the single shot *Receiver Quality* measurement. The measurement is stopped after one statistics cycle, i.e. after the number of evaluation periods (frames) set in the configuration menu *Control* (see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120) or if a stop condition is met. A measurement that has been stopped is indicated by the status display *HLT* in the associated softkey.

BER should always be used if only a single measurement result is required under fixed conditions.

Remote control
No explicit switchover command. All single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:BER...`

BER Average

The *BER Average* hotkey selects the continuous *Receiver Quality* measurement. The measurement runs until it is stopped explicitly, or until the stop condition is met. A continuous average over the selected number of evaluation periods (frames) is calculated. An ongoing measurement is indicated by the status display *RUN* in the associated softkey.

Remote control
No explicit switchover command. All continuous measurements are identified by the 2nd/3rd level keywords `...RXQuality:BAVerage...`

Neighbor Cell

The *Neighbor Cell* hotkey displays the neighbor cells reported by the mobile. The output contains up to 6 neighbor cells together with the received signal level of signals from these cells (RxLevel, see Table 4-8 on page 4.119).

Remote control
`[SENSe:]RREPorts:NCELl?`

MS Signal

The *MS Signal* softkey controls the traffic channel transmitter output signal of the mobile phone. The following settings are specific to the *Receiver Quality* measurement:

Bit Stream BER

The *Bit Stream BER* hotkey selects the data to be transmitted on the traffic channel. All pseudo random bit sequences (PRBS) provided in the *Network* tab are available (see section *Network Parameters (Connection Control – Network)* on p. 4.147 ff); however, the *Bit Stream BER* is only valid while a *Receiver Quality* measurement is active.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:BITStream[?]
PROCedure:NETWork[:CSWitched]:SMODe:BITStream[?]
CONFigure:NETWork:PDATa:BITStream[?]
PROCedure:NETWork:PDATa:BITStream
```

BS Signal

The *BS Signal* softkey determines the level and the data transmitted on the CMU's traffic channel. The following settings are specific to the *Receiver Quality* measurement:

TCH Level BER

The *TCH Level BER* hotkey sets the level of the CMU's traffic channel signal (for applications *BER* and *BER Average*). The settings remain valid for the duration of the *Receiver Quality* measurement only, see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.120.

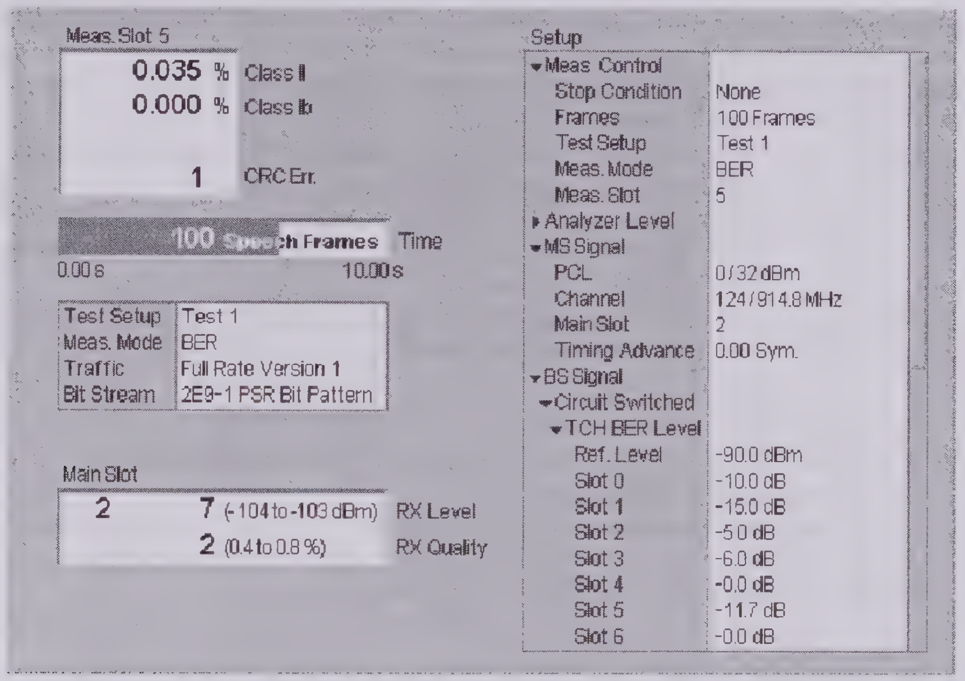
The level in the used timeslot *(used TS)* and the unused timeslots *(unused TS)* can be defined separately. The unused TS level is expressed in units relative to the level in the used timeslot. Note that the receiver quality specifications defined in GSM 05.05 must be met when the two timeslots adjacent to the used timeslot are detecting GSM signals at 20 dB above the used timeslot level. This is why the default value for the unused TS level is higher than the default used TS level.

Remote control

```
CONFigure:RXQuality:BER<nr>|BAVerage:CONTrol[:CSWitched]
  [:TCH]:LEVel:UTIMeslot
CONFigure:RXQuality:BER<nr>|BAVerage:CONTrol[:CSWitched]
  [:TCH]:LEVel:UNTimeslot
```

Measurement Results

The test settings of the current *Receiver Quality* measurement and the results are displayed in the tables in the center of the menu.



Meas. Slot 5

0.035 % Class II
0.000 % Class Ib

1 CRC Err.

100 Speech Frames Time
0.00 s 10.00 s

Test Setup	Test 1
Meas. Mode	BER
Traffic	Full Rate Version 1
Bit Stream	2E9-1 PSR Bit Pattern

Main Slot

2 7 (-104 to -103 dBm) RX Level
2 (0.4 to 0.8 %) RX Quality

Setup

Setup	
▾ Meas. Control	
Stop Condition	None
Frames	100 Frames
Test Setup	Test 1
Meas. Mode	BER
Meas. Slot	5
▸ Analyzer Level	
▾ MS Signal	
PCL	0 / 32 dBm
Channel	124 / 914.8 MHz
Main Slot	2
Timing Advance	0.00 Sym.
▾ BS Signal	
▾ Circuit Switched	
▾ TCH BER Level	
Ref. Level	-90.0 dBm
Slot 0	-10.0 dB
Slot 1	-15.0 dB
Slot 2	-5.0 dB
Slot 3	-6.0 dB
Slot 4	-0.0 dB
Slot 5	-11.7 dB
Slot 6	-0.0 dB

Fig. 4-62 Display of test settings and measurement results (BER)

The measurement results in the left upper table to depend on the selected measurement mode (see definitions at the beginning of section *Receiver Quality Measurements* on page 4.109).

RBER/FER When the residual bit error rate *(Meas. Mode = RBER/FER)* is measured the following is displayed:

Class II	Residual bit error rate for class II bits (unprotected bits)
Class Ib	Residual bit error rate for class Ib bits (partly protected bits)
FER	Frame erasure rate: relative number of invalid and therefore erased frames
CRC Error	Result of *cyclic redundancy check.* Number of frames erased on the signal path from the device under test to the CMU

BER When the bit error rate *(Meas. Mode = BER)* is measured the following is displayed:

Class II	Bit error rate for class II bits (unprotected bits)
Class Ib	Bit error rate for class Ib bits (partly protected bits)
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

Burst by Burst In a *Burst by Burst* measurement (Fast BER, *Measurement Mode = Burst by Burst),* the following is displayed:

BER	Bit error rate for class II bits (unprotected bits, no other bits are transmitted)
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

BER/DBLER

In a *Data Block Error Rate* measurement (*Measurement Mode = BER/DBLER),* the following is displayed:

BER	Bit error rate for class II bits (unprotected bits, no other bits are transmitted)
DBLER	Data block error rate: relative number of erroneous blocks; see section *BER Tests of PDTCHs* on p. 4.111 ff.
USF BLER	USF block error rate, for packet switched data channels (GPRS, with option CMU-K42) only. In circuit switched mode, the output field shows invalid results.
CRC Error	Result of *cyclic redundancy check:* number of frames erased on the signal path from the device under test to the CMU

A bar below the table indicates the relative measurement progress:

- In a *single shot* measurement, the ratio between the current measurement time and the total measurement time.
- In a *continuous* measurement, the ratio between the frames (or bursts or RLC data blocks, depending on the *Meas. Mode)* measured and the total number of frames (bursts/RLC data blocks) to be measured.

Remote Control

```
READ[:SCALar]:RXQuality:BER|BAVerage?
FETCh[:SCALar]:RXQuality:BER|BAVerage?
SAMPle[:SCALar]:RXQuality:BER|BAVerage?
```

Test Setup

The table below the measurement results indicates the current test setup together with the *Meas. Mode*, the *Traffic* mode and the *Bit Steam*. The settings are also indicated in the *Setup* table on the left side of the measurement menu.

Setup

The table *Setup* gives an overview of the configuration of the current measurement. This includes the settings made via the softkeys and hotkeys of the *Receiver Quality* menu, and the tolerances set in the *Limits* tab of the *Receiver Quality Configuration* menu, see section Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits) on page 4.123.

The parameters depend on the current application and the measurement mode.

Remote control
See sections *Test Settings* on page 4.114 and *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.123.

MS Rcv. Reports – Received Results of the Mobile Phone

GSM mobile phones continuously measure the signal strength and quality of several nearby base stations. The measured values for the active base station (serving cell BTS) are regularly sent to the active base station (in this case: the CMU) in the so-called “measurement reports”. They are thus automatically provided and do not represent real measured quantities.

The quantities characterizing the signal strength and quality of the serving cell (i.e. the CMU's traffic channel signal) are displayed together with the *Main Timeslot* number in a table in the lower left part of the *Receiver Quality* menu.

RX Level

The output window *RX Level* indicates the received signal input level determined by the mobile for the signals of the CMU.
The level is expressed in terms of dimensionless power levels depending linearly on the absolute measured power. A high power level implies a high received signal input power:

Table 4-8 Definition of RX Level

Value of RX Level	Corresponding signal strength
63	> –48 dBm
62	–49 dBm to –48 dBm
62	–50 dBm to –49 dBm
...	...
2	–109 dBm to –108 dBm
1	–110 dBm to –109 dBm
0	< –110 dBm

Remote control
`[SENSe:]RREPorts:RXLevel?`

RX Quality

The output window *RX Quality* indicates the received signal quality determined by the mobile for the signals of the CMU.
The received signal quality is expressed in terms of dimensionless quality levels (actually "error levels") depending linearly on the logarithm of the bit error rate. A high quality level implies a high bit error rate and thus a **poor** received signal quality:

Table 4-9 Definition of RX Quality

Value of RX Quality	Bit error rate
0	0% to 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%
4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	12.8% to 100%

Remote control
`[SENSe:]RREPorts:RXQuality?`

The receiver reports of up to six neighbor cells of the serving cell can be displayed using the *Neighbor Cell* hotkey, see page 4.114.

Measurement Configurations (Receiver Quality Configuration)

The popup menu *Receiver Quality Configuration* contains two tabs which determine the parameters for measurement of the bit error rate.

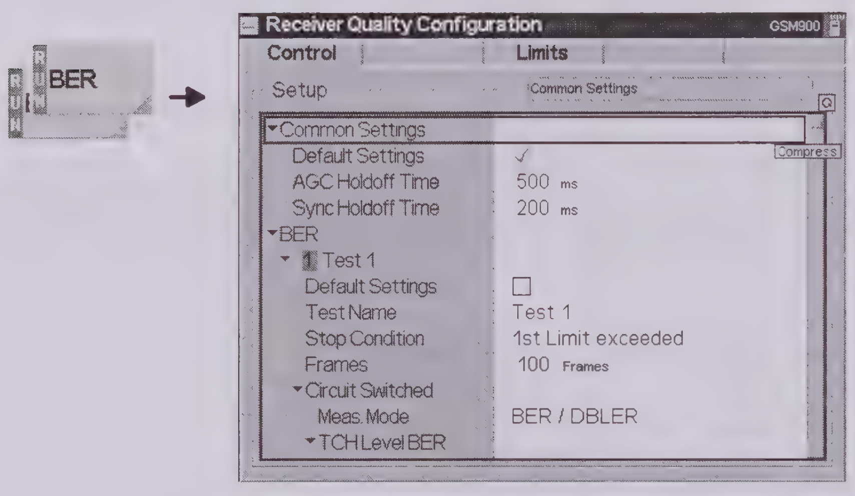
The popup menu *Receiver Quality Configuration* is opened by pressing the measurement control softkey *BER/ BER Average* at the top right in the main menu *Receiver Quality* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Receiver Quality Configuration – Control)

The *Control* tab controls the *Receiver Quality* measurement by determining

- Settling times for the mobile after which the measurement is started *(AGC/Sync. Holdoff Time)*
- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measured quantity *(Meas. Mode)*
- The levels in the traffic channel *(TCH Level BER)* set during the *Receiver Quality* measurement

With the exception of the holdoff times, all settings can be defined separately for the two applications *BER* (with up to ten different test setups) and *BER Average*.



▾Common Settings
Default Settings ✓
AGC Holdoff Time 500 ms
Sync Holdoff Time 200 ms
▾BER
▾Test 1
Default Settings ☐
Test Name Test 1
Stop Condition 1st Limit exceeded
Frames 100 Frames
▾Circuit Switched
Meas. Mode BER / DBLER
▾TCH Level BER

Fig. 4-63 Receiver Quality – Control

Default The first *Default* switch overwrites all settings in the *Control* tab with default values. Besides, there are default switches acting on every individual BER test setup and on the continuous mode.

Remote control

```
CONFigure:RXQuality:CONTrol:DEFault  ON | OFF
CONFigure:RXQuality:BER<nr>:CONTrol:DEFault  ON | OFF
CONFigure:RXQuality:BAVerage:CONTrol:DEFault  ON | OFF
```

Common Settings The *Common Settings* section lets you specify holdoff times necessary for the adjustment of the mobile station to the BER measurement and the loop-back of the bit stream.

AGC Holdoff Time	Time during which the mobile can adjust itself to the new RF level at the beginning of the Receiver Quality measurement (automatic gain control). The *AGC Holdoff Time* is also applied if the RF level changes during the *Receiver Quality* measurement.
Sync Holdoff Time	Delay time after which the signalling unit of the CMU starts synchronizing to the bit stream. This holdoff time is not applied

in the case of RF level changes during the *Receiver Quality* measurement.

Both holdoff times depend on the performance of the mobile station. A reduction of the holdoff times towards their mobile-dependent lower limits can accelerate the measurement.

Remote control

```
CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>,<SynchTime>
```

BER Test Setup

The *BER* table section defines up to 10 user-specific configuration files for single shot *Receiver Quality* measurements (application *BER).* The test setups are numbered from 1 to 10 and can be called up via the *Test Setup* hotkey associated to the *BER* softkey. They differ from each other in the default settings for the signal power of the CMU and the criteria for analysis.

Remote control

The application number is denoted by a numeric suffix in the RXQuality commands `(...RXQuality:BER<nr>:...)`.

Test Name

The *Test Name* option assigns a name to each of the 10 test setups. In the *Test Setup* hotkey, the individual test setups are referenced with their *Test Names*.

Remote control

A numeric suffix in the RXQuality commands `(...RXQuality:BER<nr>:...)` denotes the application number.

Stop Condition

The *Stop Condition* parameter defines a stop condition for the measurement:

NONE	Continue measurement even in case of error
1st Limit exceeded	Stop measurement on first error (tolerance exceeded)
All Limits exceeded	Stop measurement if all tolerances are exceeded

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition
  ALIMits | FLIMit | NONE,<StepMode>
CONFigure:RXQuality:BAVerage:CONTrol:REPetition
  ALIMits | FLIMit | NONE,<StepMode>
```

Frames

The parameter *Frames* defines the statistic count (= the number of speech frames to be sent in a *BER* measurement). A low value permits to limit the scope and accelerate the measurement.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol <Mode>,<FramesToSend>
```

Average

The parameter *Average* defines the number of frames to be averaged in a *BER Average* measurement.

Remote control

```
CONFigure:RXQuality:BAVerage:CONTrol
         <Mode>,<FramesToAverage>
```

Meas. Mode

The *Meas. Mode* parameter determines the measured quantity:

BER	Bit error rate (separately for class II and class Ib bits)
RBER/FER	Residual bit error rate (separately for class II and class Ib bits) and frame erasure rate
Burst by Burst	Accelerated measurement, only class II bits are transmitted
BER/DBLER	Bit error rate and data block error rate; see section *BER Tests of PDTCHs* on p. 4.111 ff. For packet switched data channels (GPRS, with option CMU-K42), the USF BLER is available in addition.

All measured quantities are defined at the beginning of section *Receiver Quality Measurements* on page 4.109 ff.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol
  RFER | BER | BBB,<FramesToSend>
CONFigure:RXQuality:BAVerage:CONTrol
  RFER | BER | BBB,<FramesToSend>
```

The following level settings for the BS traffic channel are valid during the *Receiver Quality* measurement only; they don't supersede the downlink levels defined in the *Slot Configuration Editor* described in section *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff. Two alternative ways of defining the TCH levels are provided: Depending on the *Level Mode* setting in the *Slot Configuration Editor*, either the *TCH Level BER* or the *Individual Levels BER* is used.

TCH Level BER

The *TCH Level BER* section defines the traffic channel level in the *Used/Unused* level mode (see *Level Mode* softkey in section *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.).

used Timeslot	Absolute level in all active (used) timeslots
unused Timeslot	Level in the unused timeslots of the traffic channel relative to the level in the used timeslots.

The level in the used timeslot(s) is specified in dBm. The allowed level range depends on the selected RF output of the CMU and the external attenuation set.

The level in the unused timeslots is specified relative to the level in the used timeslot(s) in dB. The actual level in the unused timeslots must also lie within the permissible range for the RF outputs. This condition may place an additional restriction on the permissible level range for the unused timeslots.

Remote control

```
CONFigure:RXQuality:BER:CONTrol[:CSWitched][:TCH]
          :LEVel:UTIMeslot
CONFigure:RXQuality:BER:CONTrol[:CSWitched][:TCH]
          :LEVel:UNTimeslot
```

Individual Levels BER

The *Individual Levels BER* section defines the traffic channel level in the *Individual* level mode (see *Level Mode* softkey in section *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.).

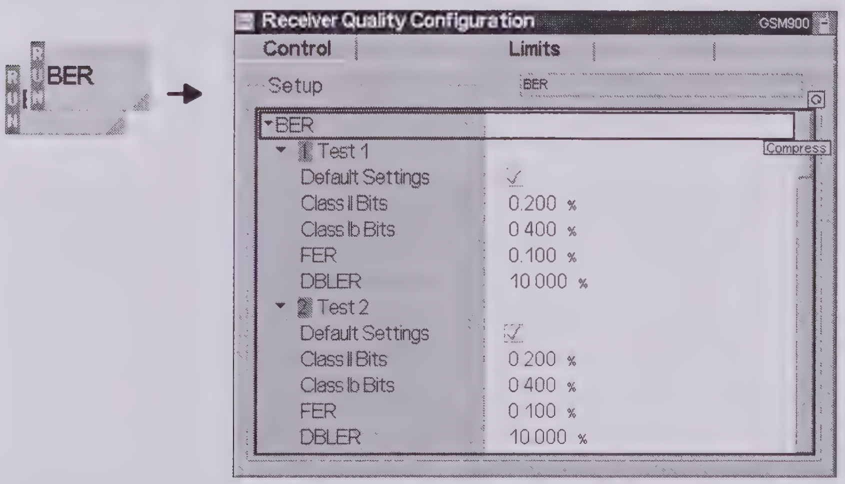
Reference Level	Absolute reference level for the individual downlink (BS) signal levels.
Slot 0 to 7	Level in the individual timeslots in dB, relative to the reference level.

The allowed level range depends on the selected RF output of the CMU and the external attenuation set.

Remote control
```
CONFigure:RXQuality:BER:CONTrol[:CSWitched][:TCH]
         :LEVel:REFLevel
CONFigure:RXQuality:BER:CONTrol[:CSWitched][:TCH]
         :MSLot:RLEVel
CONFigure:RXQuality:BER:CONTrol[:CSWitched][:TCH]
         :MSLot:LEVel:INDividual
```

Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)

The *Limits* tab defines the upper limits for the individual measured quantities in the Receiver Quality menu. All settings can be defined separately for the two applications *BER* (with up to ten different test setups) and *BER Average*. Which of the configured quantities are actually measured depends on the measurement mode set *(BER, RBER/FER*, or *Burst by Burst*, see section *Measurement Results* on page 4.116).



Setup: BER

- BER
  - Test 1

Default Settings	✓
Class II Bits	0.200 %
Class Ib Bits	0.400 %
FER	0.100 %
DBLER	10.000 %

  - Test 2

Default Settings	✓
Class II Bits	0.200 %
Class Ib Bits	0.400 %
FER	0.100 %
DBLER	10.000 %

Fig. 4-64 Receiver Quality Configuration – Limits

Default Settings The *Default* switches overwrite the settings belonging to an individual BER test setup or to the BER Average mode.

Remote control
```
CONFigure:RXQuality:BER<nr>:LIMit:DEFault  ON | OFF
CONFigure:RXQuality:BAVerage:LIMit:DEFault  ON | OFF
```

Class II Bits Upper limit of the bit error rate (or residual bit error rate or burst by burst bit error rate, depending on the mode) for class II bits (unprotected bits) in the value range 0% to 100%.

Remote control
```
CONFigure:RXQuality:BER<nr>|BAVerage:LIMit:CLII <ClassIIBER>
```

Class Ib Bits Upper limit of the bit error rate (or residual bit error rate, depending on the mode) for class Ib bits (partly protected bits) in the value range 0% to 100%.

Remote control
```
CONFigure:RXQuality:BER<nr>|BAVerage:LIMit:CLIB <ClassIbBer>
```

FER Upper limit for frame error rate (frame erasure rate), relative number of invalid and therefore erased frames in the value range 0% to 100% (only measured in measurement mode *RBER/FER)*.

	The default settings for the three upper limits reflect the importance of the three measured quantities for evaluation of the transmission and received-signal quality (in the case of unprotected bits, a higher error rate is expected and accepted than in the case of protected bits, etc.). Remote control `CONFigure:RXQuality:BER<nr>|BAVerage:LIMit:FERRors <Frame_Errors>`
DBLER	Upper limit of the Data Block Error Rate in the value range 0% to 100% (only measured in measurement mode *BER/DBLER)*. Remote control `CONFigure:RXQuality:BER:LIMit:DBLer`
USF BLER	Upper limit of the USF Block Error Rate in the value range 0% to 100%. Only measured in measurement mode *BER/DBLER* and on packet switched data channels (GPRS, option CMU-K42). Remote control `CONFigure:RXQuality:BER:LIMit:USFBler`

Connection Control

The menu group *Connection Control* controls the signalling procedures (call setup and release, services, signalling parameters) and determines the inputs and outputs with the external attenuation values and the reference frequency.

The purpose of the *Signalling* test mode is to perform transmitter and receiver tests with an existing call (or data transfer) connection between the CMU and the mobile. Therefore the menus for setting up a connection (*Connection Control – Connection)* appear immediately after the function group and mode *GSM400/850/900/1800/1900-MS Signalling* is activated. Besides, all the tabs in the *Connection Control* menu can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. Pressing the *Escape* key closes the active *Connection Control* menu and re-activates the underlying measurement menu.

The tabs *Connection Control – Connection* displayed during synchronization are described at the beginning of section *GSM Measurements with Signalling* on p. 4.80 ff. The remaining *Connection Control – Connection* tabs are described below.

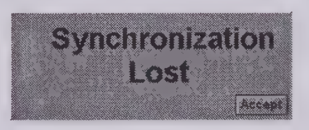
Connection Control in the Synchronized State

In addition to the parameter overview described in section *Connection Control with Call Established* on p. 4.128 ff., the *Network Support* and *Main Service* softkeys, and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on p. 4.81 ff., the *Connection (Synchronized)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the control channel signal for synchronization *(Signal Off)*
- Establishing a call to the mobile station (*Connect Mobile* -> state *Alerting)*
- Short message service *(Send SMS* -> return to state *Synchronized).*

The popup menu *Connection (Synchronized)* is opened when a successful call (in which case a location update is considered as being already performed) is released *(Disconnect Mobile* softkey in the *Alerting* or in the *Call Established* state, MS call release, loss of radio link) or when a location update is initiated by the mobile phone. It is replaced by the *Connection (Alerting)* menu if the CMU initiates a call to the mobile phone (Softkey *Connect Mobile),* or by the *Connection (Call Established)* menu if the mobile phone initiates a call to the CMU, see Fig. 4-43 on page 4.81.

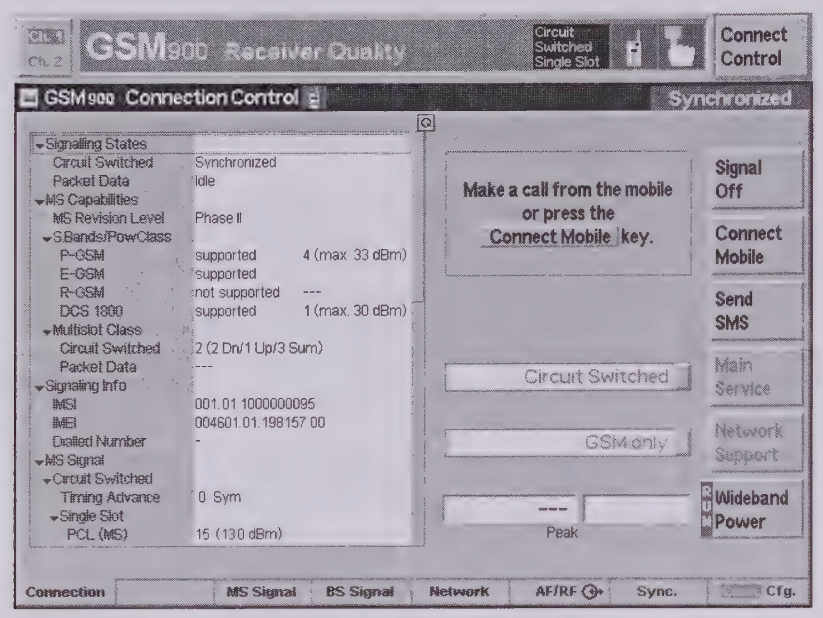
Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning Synchronization Lost ! will appear.*



Synchronization Lost

At the same time, bit 2 is set in the STATus:OPERation register. To continue, confirm that you received the message by pressing the Accept button.

Connect Control →



Signaling States		
Circuit Switched	Synchronized	
Packet Data	Idle	
MS Capabilities		
MS Revision Level	Phase II	
S.Bands/PowClass		
P-GSM	supported	4 (max 33 dBm)
E-GSM	supported	
R-GSM	not supported	---
DCS 1800	supported	1 (max. 30 dBm)
Multislot Class		
Circuit Switched	2 (2 Dn/1 Up/3 Sum)	
Packet Data	---	
Signaling Info		
IMSI	001.01 1000000095	
IMEI	004601.01.198157 00	
Dialled Number	-	
MS Signal		
Circuit Switched		
Timing Advance	0 Sym	
Single Slot		
PCL (MS)	15 (13.0 dBm)	

Make a call from the mobile or press the Connect Mobile key.

Fig. 4-65 Connection Control – Connection (Synchronized)

The function of the *Power* softkey is described in the section *Signalling Control without Signal (State Signal Off)* on page 4.81, the softkeys *Signal Off* and *Send SMS* in the section *Connection Control with Signal (State Signal On)* on page 4.84.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection Control with Call Established* on p. 4.128 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message (here: *Make a call from the mobile or press the "Connect Mobile" key)* displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Connect Mobile

The softkey *Connect Mobile* establishes a call to the mobile station.
A user prompt below the header indicates the function of this softkey. After it is pressed the two successive header messages *Paging in progress ... Call to mobile in progress* are displayed. As soon as the mobile responds (rings), the CMU changes to the signalling state *Alerting.* As soon as the call is accepted at the mobile, the CMU changes to the signalling state *Call Established*.

Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion MTC`

Connection Control in the Alerting State

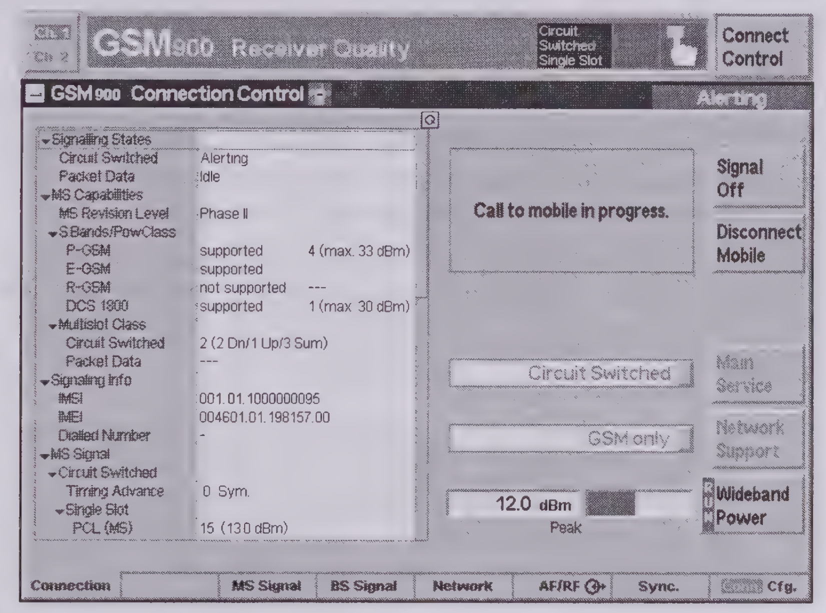
In addition to the parameter overview described in section *Connection Control with Call Established* on p. 4.128 ff., the *Network Support* and *Main Service* softkeys, and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on p. 4.81 ff., the *Connection (Alerting)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the control channel signal for synchronization and call release *(Signal Off)*
- *Disconnect Mobile* while keeping the control channel signal switched on (-> state *Synchronized)*

The popup menu *Connection (Alerting)* is opened while the mobile phone is ringing during a call setup *(Connect Mobile* softkey in the *Signal On* or in the *Synchronized* state). It is replaced by the *Connection*

(Call Established) menu when the mobile phone accepts the call (is picked up), or by the *Connection (Synchronized)* menu if the call is released *(Disconnect Mobile* softkey, MS call release, alert timeout, loss of radio link), see Fig. 4-43.

Connect. Control →



Signalling States		
Circuit Switched	Alerting	
Packet Data	Idle	
MS Capabilities		
MS Revision Level	Phase II	
S.Bands/PowClass		
P-GSM	supported	4 (max. 33 dBm)
E-GSM	supported	
R-GSM	not supported	---
DCS 1800	supported	1 (max. 30 dBm)
Multislot Class		
Circuit Switched	2 (2 Dn/1 Up/3 Sum)	
Packet Data	---	
Signaling Info		
IMSI	001.01.1000000095	
IMEI	004601.01.198157.00	
Dialled Number	-	
MS Signal		
Circuit Switched		
Timing Advance	0 Sym.	
Single Slot		
PCL (MS)	15 (13.0 dBm)	

Call to mobile in progress.

Circuit Switched

GSM only

12.0 dBm Peak

Fig. 4-66 Connection Control – Connection (Alerting)

The function of the *Wideband Power* softkey is described in the section *Signalling Control without Signal (State Signal Off)* on page 4.81, the softkey *Signal Off* softkey in section *Connection Control with Signal (State Signal On)* on page 4.84.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection Control with Call Established* on p. 4.128 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Disconnect Mobile

The *Disconnect Mobile* softkey releases the call to the mobile station. The CMU changes to the signalling state *Synchronized*.

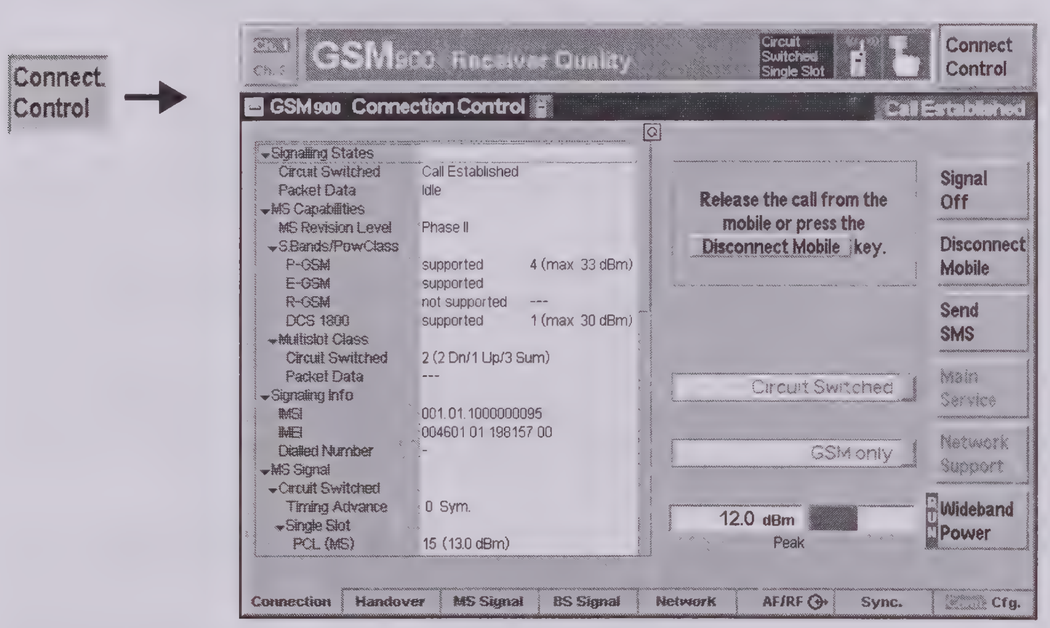
Remote control
`PROCedure:SIGNalling[CSWitched]:ACTion CRELease`

Connection Control with Call Established (State Call Established)

In addition to the parameter overview described in section *Connection Control with Call Established* on p. 4.128 ff., the *Network Support* and *Main Service* softkeys, and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on p. 4.81 ff., the *Connection (Call Established)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the signal for synchronization and call release to the mobile station *(Signal Off)*
- Call release to mobile station (*Disconnect Mobile* -> state *Synchronized)*
- Short message service *(Send SMS* -> return to state *Call Established)*

The popup menu *Connection (Call Established)* can be opened after a call from the CMU *(Call to MS* softkey in the *Signal On* or in the *Synchronized* state) is accepted at the mobile or after a successful call from the mobile. It is replaced by the *Connection (Synchronized)* menu if the call is released *(Disconnect Mobile* softkey, MS call release, alert timeout, loss of radio link), or by the *Connection (Signal On)* menu if the mobile is switched off, see Fig. 4-43.



Signaling States
Circuit Switched: Call Established
Packet Data: Idle
MS Capabilities
MS Revision Level: Phase II
S.Bands/PowClass
P-GSM: supported 4 (max 33 dBm)
E-GSM: supported
R-GSM: not supported ---
DCS 1800: supported 1 (max 30 dBm)
Multislot Class
Circuit Switched: 2 (2 Dn/1 Up/3 Sum)
Packet Data: ---
Signaling Info
IMSI: 001.01.1000000095
IMEI: 004601 01 198157 00
Dialed Number: -
MS Signal
Circuit Switched
Timing Advance: 0 Sym.
Single Slot
PCL (MS): 15 (13.0 dBm)

Release the call from the mobile or press the Disconnect Mobile key.

Fig. 4-67 Connection Control – Connection (Call Established)

The function of the softkeys *Signal Off* and *Wideband Power* is described in section *Signalling Control without Signal (State Signal Off)* on page 4.81, the *Send SMS* softkey in section *Connection Control with Signal (State Signal On)* on page 4.84, the *Disconnect Mobile* softkey in section *Connection Control in the Alerting State* on page 4.126.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signalling States The *Signalling States* section indicates the current signalling states of the CMU in GSM *(Circuit Switched,* see Fig. 4-43 on p. 4.81*)* and GPRS *(Packet Data)* mode. GSM and GPRS states are independent from each other. The GPRS signalling scheme is described in section GPRS Signalling on p. 4.157 ff.

The signalling states of the CMU are changed by means of the right softkeys in the *Connection* tabs of the *Connection Control* menu; see below.

Remote control
`[SENSe]:SIGNalling[:CSWitched]:STATe?`
`[SENSe]:SIGNalling:PDATa:STATe?`

MS Capabilities

The *MS Capabilities* section indicates the characteristics of the mobile station under test. Valid parameter values are available as soon as the CMU has reached the GSM *Synchronized* or in the GPRS *Attached* signalling states. The *Dialed Number* is shown after a *Call from MS*.

MS Revision Lev.	GSM phase (Phase 1, Phase 2 or Phase 2+) of the mobile station
Supp. Bands/PC	Supported GSM band(s), power class and nominal maximum output power in dBm of the mobile station. For GSM900 mobile stations, the R-GSM, E-GSM, and P-GSM subbands are also indicated, e.g. *E-GSM / 1 (max. 39 dBm).* For mobiles supporting several GSM bands or subbands, several lines are indicated.
Multislot Class	Multislot class of mobile station in GSM *(Circuit Switched)* and GPRS *(Packet Data)* mode and in the format *<Multislot Class> (<max. no. of downlink slots> Dn/<max. no. of uplink slots> Up/<Sum> Sum)*, e.g. 4 (2 Dn/2 Up/3 Sum). A mobile station may indicate different multislot classes for circuit mode services and for GPRS (see GSM 04.08). The MS multislot classes are defined in 3GPP TS 05.02 and listed in Table 4-10 below.

Remote control
`[SENSe:]MSSinfo:POWer:CLASs?`
`[SENSe:]MSSinfo:REVision?`

Table 4-10: MS multislot classes

Multislot class	**Maximum number of slots**		
	Downlink (MS RX)	**Uplink (MS TX)**	**Sum**
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
13	3	3	not applicable
14	4	4	not applicable
15	5	5	not applicable
16	6	6	not applicable
17	7	7	not applicable
18	8	8	not applicable
19	6	2	not applicable
20	6	3	not applicable
21	6	4	not applicable
22	6	4	not applicable
23	6	6	not applicable
24	8	2	not applicable
25	8	3	not applicable
26	8	4	not applicable
27	8	4	not applicable
28	8	6	not applicable
29	8	8	not applicable

RX describes the maximum number of receive timeslots that the MS can use per TDMA frame. TX describes the maximum number of transmit timeslots that the MS can use per TDMA frame. The MS must be able to support all integer values of receive timeslots from 0 to RX and all integer values of transmit timeslots from 0 to TX (depending on the services supported by the MS).

Sum is the total number of uplink and downlink TS that can actually be used by the MS per TDMA frame. The MS must be able to support all combinations of integer values of RX and TX timeslots where 1 ≤ RX + TX ≤ Sum (depending on the services supported by the MS). Sum is not applicable to all classes.

MS Capabilities – Signalling Info

The *Signalling Info* section indicates the code numbers identifying the mobile station under test and the dialed number.

IMSI	International mobile subscriber identity in the format MCC.MNC.MSIN
MCC	3-digit mobile country code
MNC	2-digit mobile network code (3-digit for GSM850 and GSM1900)
MSIN	10-digit mobile subscriber id. no. (9-digit for GSM850 and GSM1900)
IMEI	international mobile station equipment identity in the format TAC.FAC.SNR.SVN
TAC	6-digit type approval code
FAC	2-digit final assembly code
SNR	6-digit serial no.
SVN	1|2-digit software version number
Dialed Number	Number dialed at the mobile station *(Call from MS)*

Remote control
```
[SENSe:]MSSinfo:IMSI:MCC?
[SENSe:]MSSinfo:IMSI:MNC?
[SENSe:]MSSinfo:IMSI:MSIN?
[SENSe:]MSSinfo:IMEI:TAC?
[SENSe:]MSSinfo:IMEI:FAC?
[SENSe:]MSSinfo:IMEI:SNR?
[SENSe:]MSSinfo:IMEI:SVN?
[SENSe]:MSSinfo:DNUMber
```

MS Signal

The *MS Signal* section indicates important parameters describing the signals that the MS is to transmit. These parameters are set in the *MS Signal* tab and explained in greater detail there (see section *RF Signals of the MS (Connection Control – MS* Signal) on page 4.133 ff.).

Remote control
```
CONFigure:MSSignal...
```

BS Signal

The *BS Signal* section indicates important parameters describing the signals that the CMU transmits in the state *Signal On*. These parameters can be set in the *BS Signal* tab and are explained there in more detail (see section *RF Signals of the CMU (Connection Control – BS Signal)* on page 4.141 f.).

Remote control
```
CONFigure:BSSignal...
```

Network The *Network* section indicates the most important network parameters currently used by the CMU. These parameters can be set in the *Network* tab and are explained there in more detail (see section *Network Parameters (Connection Control – Network)* on page 4.147).

Remote control
`CONFigure:NETWork...`

AF/RF → The table *AF/RF →* indicates the RF connectors and external attenuation settings. These parameters are set in the tab AF/*RF* → and are explained in greater detail there (see section *RF Connectors (Connection Control – RF Input/Output.)* on page 4.76 ff.).

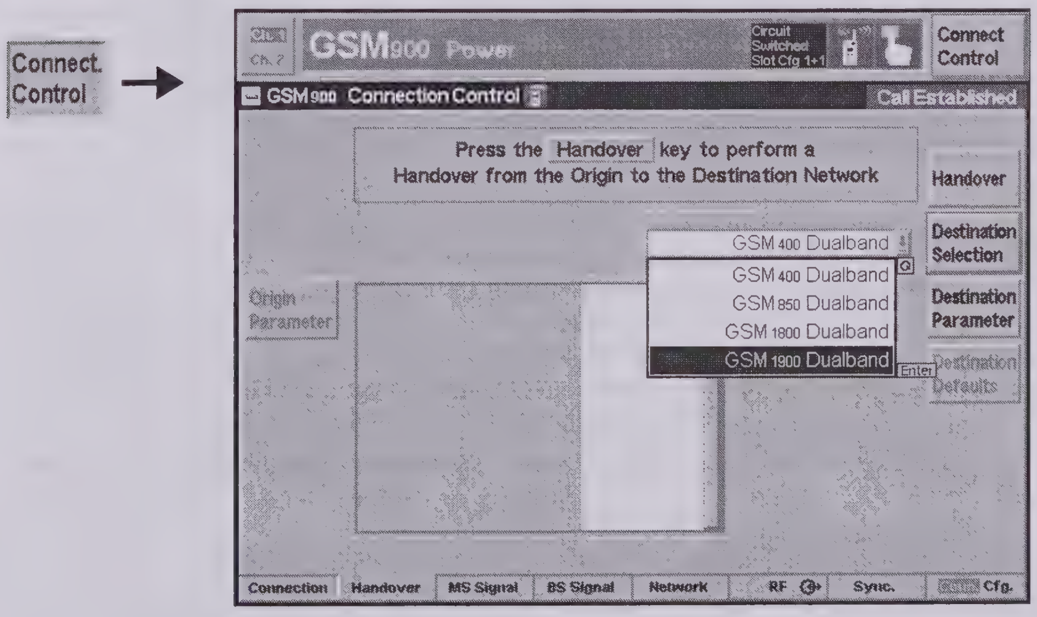
Remote control
`[SENSe:]CORRection:LOSS...?`

Handover to another Network (Connection Control – Handover)

The *Handover* tab initiates a handover of the call connection to a different network. It is therefore available in the *Call Established* signalling state only. Handover includes:

- Selection of the target network *(Destination Selection)* and the handover parameters *(Destination Parameter, Destination Defaults)*
- Start of the handover procedure *(Handover)*
- Return to the original network *(Origin Parameter)*

Note: *Handover is only supported for Circuit Switched* Main Service *(see section* Signalling Control without Signal (State Signal Off) *on p. 4.81 ff.). The handover tab can not be accessed in Packet Data (GPRS) mode.*



Press the Handover key to perform a Handover from the Origin to the Destination Network

Fig. 4-68 Connection Control – Handover (destination selection)

Destination Selection

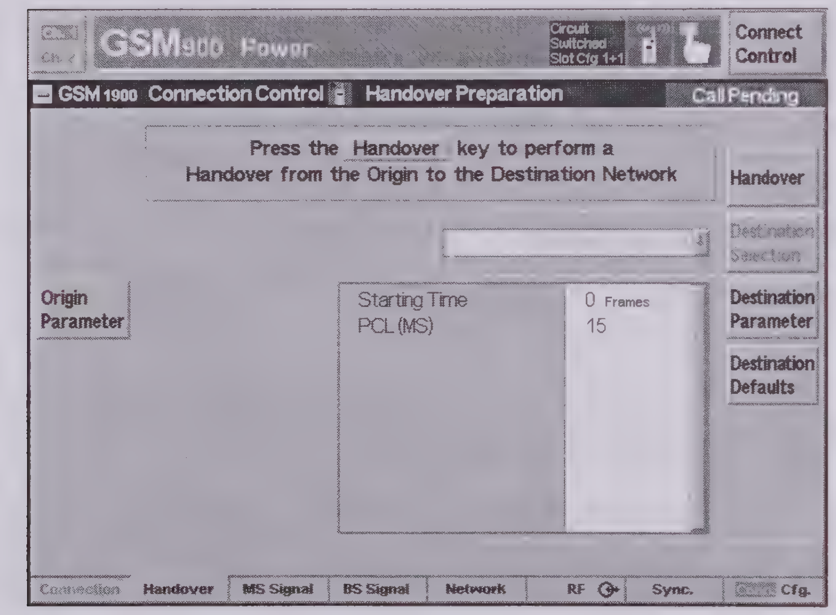
The softkey *Destination Selection* selects the target network for handover.

Dual-band handover between all enabled GSM bands is provided. Once the selection is confirmed via *Enter*, the CMU changes to the *Call Pending* signalling state. In this state, the entire *Connection Control* menu is mapped onto the target function group, so it is possible to edit the *Destination Parameters* (see below), the *BS Signal*, and the *Network* parameters of the target network.:

Remote control

```
STATus:HANDover:TARGet:LIST?
CONFigure:HANDover:TARGet <Target>
```

Note: Call Pending *is an intermediate signalling state that only occurs in the context of a handover process. For a complete overview of signalling states see Fig. 6.1 in chapter 6 of this manual.*



Press the Handover key to perform a
Handover from the Origin to the Destination Network

Starting Time 0 Frames
PCL (MS) 15

Fig. 4-69 Connection Control – Handover (Call Pending)

Destination Parameter

The *Destination Parameter* softkey sets important target network parameters that come into effect as soon as the call is handed over.

Starting Time	Time interval (in frames) after which the mobile station performs a new registration with the base station after a channel, timeslot, and fast power change.
PCL (MS)	Power control level used by the mobile station to call and perform a location update in the target network.

See also section *Network Parameters (Connection Control – Network)* on page 4.147 ff.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:STIMe <Frames>
CONFigure:MSSignal:CCH:PMAX <PCL>
```

Destination Defaults

The *Destination Defaults* softkey sets the parameters of the target network to default values.

Remote control
`CONFigure:NETWork[:CSWitched]:SMODe:STIMe DEF`
`CONFigure:MSSignal:CCH:PMAX DEF`

Handover

The *Handover* softkey initiates a handover to the target network.

Remote control
`PROCedure:SIGNalling[:CSWitched]:ACTion HANDover`

Origin Parameter

The *Origin Parameter* softkey cancels the *Handover* procedure and resets the CMU to the *Call Estabished* signalling state.

The destination parameters set in the *Call Pending* state are maintained. To drop the *Handover* procedure and return to the measurement mode, press the *ESCAPE* key or the *Connection Control* softkey.

Remote control
`CONFigure:NETWork[:CSWitched]:SMODe:STIMe DEF`
`CONFigure:MSSignal:CCH:MAX DEF`

RF Signals of the MS (Connection Control – MS Signal)

The *MS Signal* tab configures the operating mode and the RF traffic channel signal of the MS under test. Some functions of the menu depend on the *Main Service (Circuit Switched* or *Packet Data (GPRS)* operating mode) and the *Slot Mode (Single Slot* or *Multislot* operation) of the mobile as well as on the signalling state of the CMU *(Call Established* or other states). As a consequence, settings may be disabled or even hidden in some operating modes of the CMU/MS test system. Exact information is provided in the command description in chapter 6 of this manual.

The present chapter describes the parameters related to circuit switched operation of the mobile phone. Tests in *Packet Data (GPRS)* mode require option CMU-K42. They are described in section *RF Signals of the MS (Connection Control – MS* Signal) on p. 4.164 ff.

The CMU provides a softkey-oriented version of the *MS Signal* tab and a table-oriented version with extended functionality. The *MS Signal* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-oriented Version: MS Single Slot Mode

The *Slot Mode* of the mobile can be set by means of the *Slot Mode* softkey before a call is established. While *Single Slot* mode is selected, the softkey-oriented version of the *MS Signal* tab determines

- The transmitter output power *(PCL)*, used *Timeslot*, and *Timing Advance* of the MS
- The routing of the speech data *(DAI)*

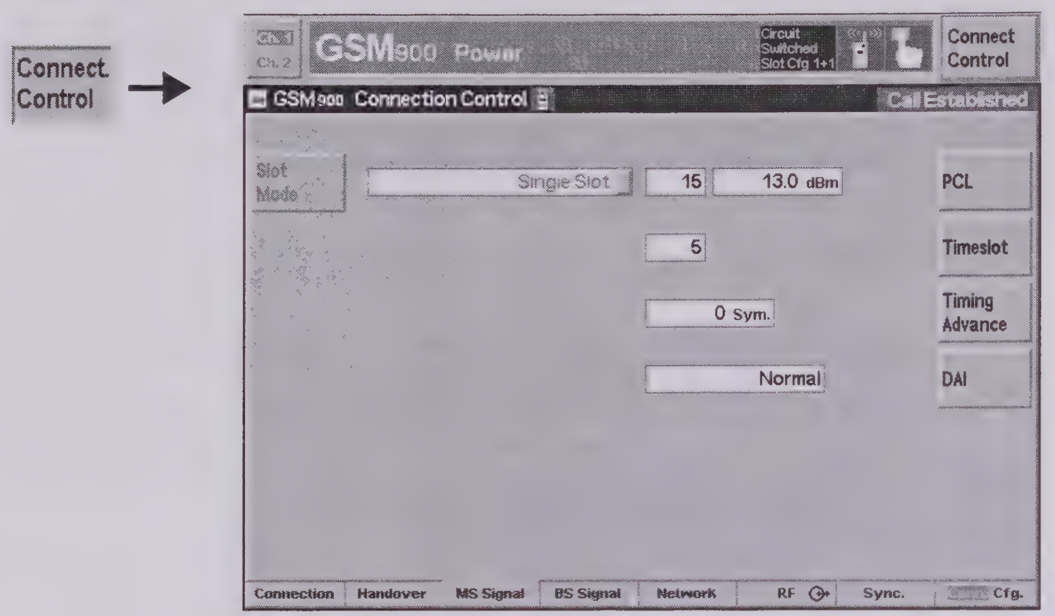


Fig. 4-70 Connection Control – MS Signal (panel)

Slot Mode

The *Slot Mode* softkey set the mobile station under test to either *Single Slot* or *Multislot* operation. As soon as a call is established the slot mode can no longer be changed and the softkey is disabled (grayed). The *Multislot* setting changes the other softkeys in the *MS Signal* tab (see section *Softkey-oriented Version: MS Multislot* on p. 4.135). It will come into effect only if the MS under test is capable of multislot operation (i.e. if it supports HSCSD or GPRS).

Remote control
`CONFigure:SIGNalling[:CSWitched][:TCH]:SMODe SSL | MSL`

PCL

The *PCL* softkey sets (signalling states < *Call Established)* or changes (signalling states *Call Established)* the MS output power during the connection. The softkey is identical to the *PCL (MS)* parameter in the table-oriented version of the MS Signal tab.

The MS transmitter output power can be selected in PCL (Power Control Level) units or as a corresponding absolute power value (in dBm with a 2 dBm spacing); see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.103.

Note: Power *measurements on normal bursts are performed at the MS output power set via* PCL *or the corresponding parameters for multislot or packet data mode. In contrast, the access burst is transmitted before a call is set up. The* P/t Access Burst *measurement is performed at the maximum power for the cell* PMAX *(see* PMAX *parameter on p. 4.139*).

Caution: If very small MS powers are specified, the mobile station, depending on its power class or GSM phase (phase 1 or 2, may actually transmit at a higher power so that the CMU may be overdriven.

Example (GSM900): The minimum level of phase 2 mobile phones is 5 dBm (PCL 19), the minimum level of phase 1 is 13 dBm (PCL 15). If PCL 19 is set but a phase 1 mobile station is used, this mobile will transmit at 13 dBm (PCL 15).

Remote control
`CONFigure:MSSignal[:CSWitched][:TCH][:SSLot]:MS:PCL`
`PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:MS:PCL`

Timeslot

The *Timeslot* softkey determines the timeslot for the MS traffic channel.

Remote control
`PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot`
`CONFigure:MSSignal:MCONtrol:MESLot`

Timing Advance

The *Timing Advance* softkey sets a (positive) delay time (in bit) correcting the timing of the mobile. In the network, timing advance is to compensate for the propagation time of the signal from the BTS to the mobile and back.

Remote control
`PROCedure:SIGNalling[:CSWitched][:TCH]:TADVance`
`CONFigure:MSSignal[:CSWitched][:TCH]:TADVance`

DAI Acoustic Dev.

The *DAI Acoustic Dev.* determines the routing of the speech data (Digital Audio Interface (DAI) of the mobile or internal, i.e. normal mode) and which device is being tested (speech transcoder/DTX functions or A/D & D/A):

The DAI can be set to one of the following modes:

Normal	Normal operation of the mobile; default setting during a call setup
Decoder	Test of speech decoder / DTX functions (downlink)
Encoder	Test of speech encoder / DTX functions (uplink)
Acoustic Devices	Test of acoustic devices and A/D & D/A

When entering the *Call Established* state, the DAI setting is always *Normal*. The other options must be set explicitly after each call setup.

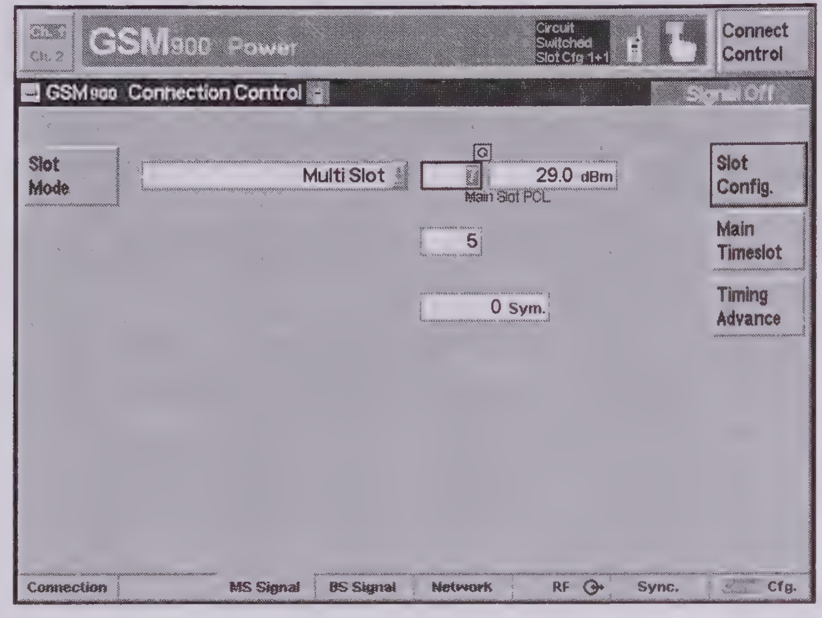
Remote control
`PROCedure:SIGNalling[:CSWitched]:DAI <Interface>`

Softkey-oriented Version: MS Multislot Mode

The *Slot Mode* of the mobile can be set by means of the *Slot Mode* softkey (see p. 4.134) before a call is established. While *Multislot* mode is selected, the softkey-oriented version of the *MS Signal* tab determines

- The transmitter output power in the main timeslot *(Main Slot PCL)*, the *Main Timeslot* number
- The *Timing Advance* of the MS; see section *Softkey-oriented Version: MS Single Slot Mode* on p. 4.133 f.
- The levels in all uplink and downlink timeslots *(Slot Config.)*

Connect. Control →



Slot Mode: Multi Slot

Main Slot PCL: 29.0 dBm

5

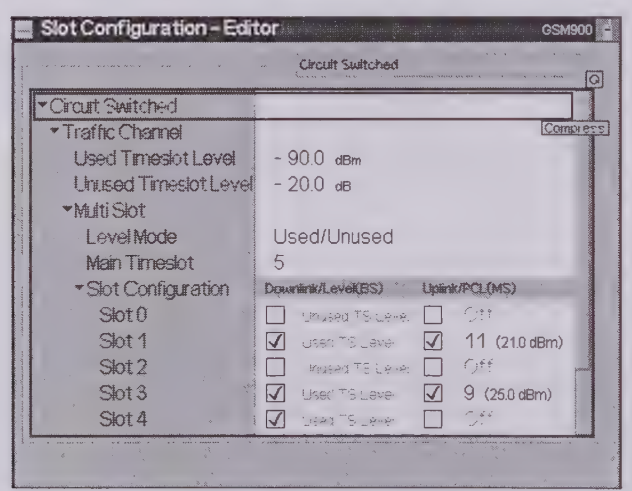
0 Sym.

Fig. 4-71 Connection Control – MS Signal (panel)

Slot Config.

The *Slot Config.* softkey sets the output power of the mobile station transmitter in the main timeslot (see below). The output power can be selected in PCL (Power Control Level) units or as a corresponding absolute power value (in dBm with a 2 dBm spacing); see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.103.

Pressing the *Slot Config.* softkey twice opens the *Slot Configuration Editor:*



▾Circuit Switched		
▾Traffic Channel		
Used Timeslot Level	- 90.0 dBm	
Unused Timeslot Level	- 20.0 dB	
▾Multi Slot		
Level Mode	Used/Unused	
Main Timeslot	5	
▾Slot Configuration	Downlink/Level(BS)	Uplink/PCL(MS)
Slot 0	☐ Unused TS Level	☐ Off
Slot 1	☑ Used TS Level	☑ 11 (21.0 dBm)
Slot 2	☐ Unused TS Level	☐ Off
Slot 3	☑ Used TS Level	☑ 9 (25.0 dBm)
Slot 4	☑ Used TS Level	☐ Off

The *Slot Configuration Editor* determines the levels in all uplink and downlink timeslots.

Circuit Switched – Traffic Channel

The *Circuit Switched – Traffic Channel* section provides general uplink and downlink level settings. They are available only if the *Level Mode* is set to *Used/Unused* (see below).

Used Timeslot Level	Absolute level (in dBm) in all active (used) timeslots of the downlink traffic channel signal (BS signal parameter)
Unused Timeslot Level	Level in all inactive (unused) timeslots of the downlink traffic channel signal (BS signal parameter) relative to the *Used Timeslot Level* (in dB)

The value range for both levels depends on the RF output selected and of the external attenuation set, see section *Control of Input and Output Signals (Non Signalling)* on page 4.66.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot
```

Multi Slot

The *Multi Slot* section determines the main timeslot and the way the levels are defined.

Level Mode	*Individual* levels in all downlink channels or distinction between *Used/Unused* timeslots. If *Used/Unused* is selected the *Used Timeslot Level* and the *Unused Timeslot Level* can be defined in the *Traffic Channel* section. *Individual* levels are defined relative to the *Reference Level* defined below.
Reference Level	Reference value for the individual downlink (BS) signal levels. The reference level is available only if the *Level Mode* is set to *Individual* (see above).
Main Timeslot	Timeslot used for signalling. The main timeslot can not be switched off in both the downlink and uplink; see *Slot Configuration* below.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel
PROCedure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot
```

Slot Configuration

Table of all used and unused timeslots (GSM timeslots 0 to 7) in the downlink and the uplink. The *Main Timeslot* is always active (enabled) in both the downlink and uplink direction. The boxes enable (if checked) or disable the other timeslots.

Important Note:	*The CMU can transmit signals in enabled as well as in disabled downlink timeslots. Enabling a downlink timeslot means that the MS is instructed to listen to a signal in this timeslot. In the Call Established signalling state, it is no longer possible to enable or disable downlink timeslots, however, BS signal levels in all timeslots can still be changed.*
Downlink Level (BS)	RF levels in all downlink timeslots (RF signal transmitted by the BS/CMU). If the *Level Mode* is set to *Used/Unused,* the *Used Timeslot Level* and the *Unused Timeslot Level* from the *Traffic Channel* section are entered and the downlink levels in the *Slot Configuration* table can not be edited. If the *Level Mode* is set to *Individual,* all downlink levels are defined relative to the *Reference Level.*

Uplink PCL (MS)	Transmitter output power of the MS in all active (enabled) uplink timeslots. The MS transmitter output power is selected in PCL (Power Control Level) units; the corresponding absolute power value is also indicated; see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.103. If a timeslot is disabled, the corresponding output power is automatically switched *Off*.

Note: *The number of downlink and uplink channels must be compatible with the multislot class of the MS under test; see Table 4-10 on p. 4.129.*

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:UUNused
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:INDividual
CONFigure:MSSignal[:CSWitched][:TCH]:MSLot:SCONfig
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:
  SCONfig:UUNused
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:
  SCONfig:INDividual
```

Main Timeslot

The *Main Timeslot* softkey determines the timeslot that the MS and the BS/CMU use for signalling. The main timeslot can not be switched off in both the downlink and uplink; see *Slot Configuration Editor* above.

Remote control

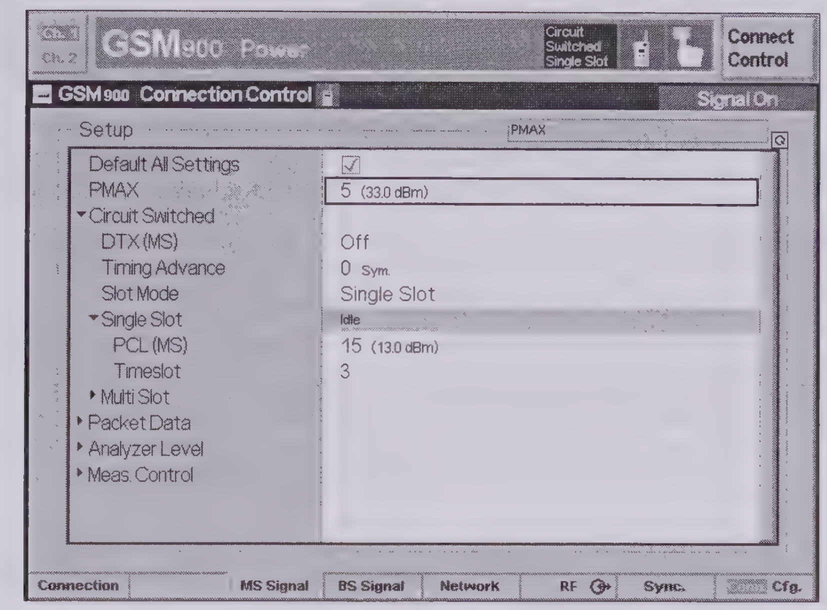
```
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot
```

Table-oriented Version

The table-oriented version of the *MS Signal* tab contains all MS signal settings of the softkey-oriented version (see sections *Softkey-oriented Version: MS Single Slot Mode* on p. 4.133 and *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.). Besides it defines:

- The Discontinuous Transmission *(DTX)* mode of the mobile station
- The maximum expected input level *(RF Max. Level)* and the way it is defined *(RF Mode)*
- An external input attenuation or gain *(RF Attenuation)*
- The trigger conditions for the measurement *(Trigger)*
- The timeslot to be measured *(Meas. Slot)*

Connect. Control →



Default All Settings	☑
PMAX	5 (33.0 dBm)
▾ Circuit Switched	
DTX (MS)	Off
Timing Advance	0 Sym.
Slot Mode	Single Slot
▾ Single Slot	Idle
PCL (MS)	15 (13.0 dBm)
Timeslot	3
▸ Multi Slot	
▸ Packet Data	
▸ Analyzer Level	
▸ Meas. Control	

Fig. 4-72 Connection Control – MS Signal (table)

The following settings are not provided in the softkey-oriented versions of the *MS Signal* tab (see sections *Softkey-oriented Version: MS Single Slot Mode* on p. 4.133 and *Softkey-oriented Version: MS Multislot Mode* on p. 4.135 ff.).

Default Settings The *Default All Settings* switch assigns default values to all settings in the *MS Signal* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
–

PMAX The *PMAX* parameter sets the maximum MS transmitter output power allowed in the cell. The value corresponds to the output power at which the mobile station performs a location update to synchronize to the CMU. It is valid both for circuit switched and for packet data mode.

The maximum MS transmitter output power can be selected in PCL (Power Control Level) units or as a corresponding absolute power value (in dBm with a 2 dBm spacing); see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.103.

Note: *PMAX defines the MS output power for access burst measurements (application* P/t Access Burst*). The other* Power *measurements are performed at the MS output power set* via PCL (MS) *(see* PCL *softkey on p. 4.134) or the corresponding parameters for multislot or packet data mode.*

Remote control
`CONFigure:MSSignal:CCH:PMAX`

Circuit Switched – DTX (MS) The *DTX (MS)* parameter decides whether or not the mobile station may use the operating mode *Discontinuous Transmission.*

In the operating mode DTX *(discontinuous transmission mode)* the *voice activity detection* of the mobile station analyzes the language elements and the intervals and decides whether a transmission is required. As a result of this, only useful information is transferred; if nothing is spoken, the mobile station will not transmit anything. The DTX method permits to reduce radio interference, the power as well as the current consumption of the mobile stations.

Note: *Since the mobile station only transmits from time to time in DTX mode, the RF measurement can only sporadically be performed by the CMU. Therefore, the DTX mode is switched* Off *in the default setting.*

Remote control
`CONFigure:MSSignal[:CSWitched]:DTX  ON | OFF`
`[SENSe:]RREPorts:DTX?`

Analyzer Level

The *Analyzer Level* table section configures the RF input path of the CMU. The functions are described in section *GSM400/850/900/1800/1900-MS Non Signalling* on page 4.72. In contrast to the *Non Signalling* mode, the *Signalling* input level can be set corresponding to the PCL of the connected mobile phone.

Analyzer Level – Mode

The *Mode* field determines the maximum input level that can be measured. The maximum input level is displayed in the parameter lines above the graphical measurement menus.

Manual	Manual input of maximum input level
PCL	Input level corresponding to the power control level of the mobile station.
Auto	Automatic setting of maximum input level *(autoranging)* according to average burst power of applied signal.

Remote control
`[SENSe:]LEVel:MODE MANual | PCL | AUTOmatic`

Trigger – Source

The *Source* field determines how the measurement is triggered:

Free Run	Trigger by the GSM input signal: The CMU detects the burst; the exact timing is given by the training sequence. This setting may slow down the measurements. *P/t Multislot, Power/Slot*, and *Power/Frame* measurements can not be performed in *Free Run* trigger mode.
RF Power	Triggering on the power (rising edge) of the incoming burst, wideband power trigger on the RF Front End
IF Power	Narrow-band IF power trigger
Signalling	Triggering by the signalling unit of the instrument, according to the expected frame timing of the RF signal re-transmitted by the MS under test (frame trigger). The frame trigger is always available while the *Signalling* test mode is active and the CMU transmits an RF signal (i.e. except in the signalling state *Signal Off*). It consists of a low-pulse TTL signal with its falling edge at the beginning of timeslot 0 of each MS TDMA frame except the idle frames. The frame trigger signal is also fed to pin 2 of the AUX 3 connector at the front of the instrument where is can be tapped off to synchronize external devices.

For the *Free Run, RF Power* and *IF Power* settings the input signal must be a burst signal. Triggering via an external signal is only possible in the *Non Signalling* mode. In contrast, *Signalling* measurements must be triggered by the signal from the signalling unit or from the mobile phone.

Some measurements require a particular trigger mode. E.g., the *Timing Advance Error* in the *Modulation* menu can be measured with *Signalling* trigger mode only.

Remote control

```
TRIGger[:SEQuence]:SOURce
  SIGNalling | FRUN | RFPower | IFPower
```

Level

The *Trigger Level* field determines the trigger threshold if the measurement is triggered by the *RF Power* or *IF Power*.

The trigger threshold is the level at which the trigger signal starts triggering. With *Free Run* measurements or *Signalling* the *Trigger Level* field is disabled.

Low	Low trigger level equal to the reference level – 26 dB
Medium	Medium trigger level equal to the reference level – 16 dB
High	High trigger level equal to the reference level – 6 dB

Remote control

```
TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH
```

Multi Slot Meas. Slot

The *Multi Slot – Meas. Slot* parameter defines in which GSM timeslot MS tests are performed. The *Meas. Slot* setting only affects the operation of the CMU. It can be changed any time without any further impact on the MS under test and the connection.

Remote control

```
CONFigure:MSSignal:MCONtrol:MESLot
```

RF Signals of the CMU (Connection Control – BS Signal)

The *BS Signal* tab configures the operating mode and the RF control and traffic channel signals that the CMU transmits to communicate with the MS under test. Some functions of the menu depend on the *Main Service (Circuit Switched* or *Packet Data (GPRS)* operating mode) and the *Slot Mode (Single Slot* or *Multislot* operation) of the mobile as well as on the signalling state of the CMU *(Call Established* or other states). As a consequence, settings may be disabled or even hidden in some operating modes of the CMU/MS test system. Exact information is provided in the command description in chapter 6 of this manual.

The present chapter describes the parameters related to circuit switched operation of the mobile phone. Tests in *Packet Data (GPRS)* mode require option CMU-K42. They are described in section RF Signals of the CMU (Connection Control – BS Signal) on p. 4.164 ff.

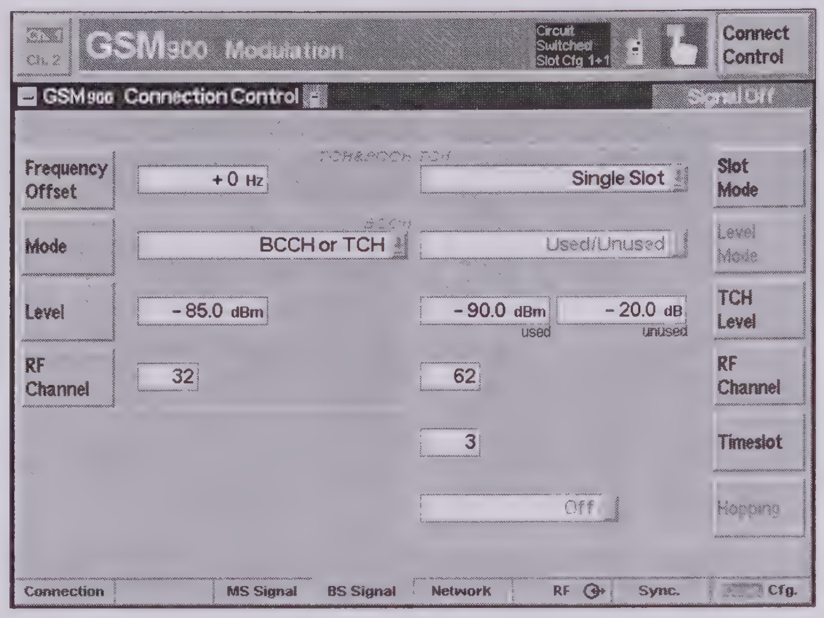
The CMU provides a softkey-oriented version of the *BS Signal* tab and a table-oriented version with extended functionality. The *BS Signal* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-oriented Version: BS Single Slot Mode

The *Slot Mode* of the mobile can be set by means of the *Slot Mode* softkey before a call is established. While *Single Slot* mode is selected, the *Level Mode* softkey is inactive. The softkey-oriented version of the *BS Signal* tab determines

- A *Frequency Offset* by which the RF frequency of the BS traffic and control channel (BCCH) signal is modified
- The transmission *Mode*, *Level* an GSM channel number *(RF Channel)* of the CMU's Broadcast Control Channel (BCCH)
- The level (TCH Level), GSM channel number *(RF Channel)*, *Timeslot* and *Hopping* sequence of the CMU's traffic channel (TCH)

Connect. Control →



Frequency Offset: +0 Hz
Mode: BCCH or TCH
Level: -85.0 dBm
RF Channel: 32
Slot Mode: Single Slot
Level Mode: Used/Unused
TCH Level: -90.0 dBm used, -20.0 dB unused
RF Channel: 62
Timeslot: 3
Hopping: Off

Fig. 4-73 Connection Control – BS Signal (panel)

The left half of the BS Signal tab contains the following BCCH settings:

Frequency Offset

The *Frequency Offset* softkey determines the frequency offset of the CMU signals from the value defined under *RF Channel*. This enables fine tuning of the signal generated by the CMU, for example for simulating a Doppler shift (due to a relative movement between mobile and CMU) or de-tuning of the base station or the MS receiver. The value range of the frequency offset is – 100 keV to +100 keV (covering the entire GSM channel width) such that the CMU is able to transmit on any frequency within the selected GMS band.

Remote control
`CONFigure:BSSignal:FM:DEViation  <Frequency>`

Mode

The *Mode* softkey defines the BS Signal configuration after a connection has been set up:

BCCH or TCH	Switch off BCCH after the connection has been established. This means that in the *Call Established* and *TBF Established* states, all timeslots are available for the TCH.
BCCH and TCH	Maintain BCCH after the connection has been established. The BCCH occupies timeslot 0 but also blocks the two adjacent timeslots (no. 7 and 1) for TCHs: Only timeslots 2 to 6 are available for BS signal traffic channels.

Remote control
`CONFigure:BSSignal:CCH:MODE BATC | BOTC`

Level

The *Level* softkey sets the absolute level (in dBm) of the BCCH control channel used for synchronization of the mobile. The value range for *Level* depends on the RF output selected and of the external attenuation set.

Remote control
`CONFigure:BSSignal:CCH:LEVel:ABSolute  <Level>`

RF Channel

The *RF Channel* softkey selects the GSM channel number of the BCCH control channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.66. In GSM900 the CMU can use all three sub-bands (P-GSM, E-GSM, R-GSM), so care must be taken that the MS supports the selected *RF Channel.*

Remote control

```
CONFigure:BSSignal:CCH:CHANnel <CCHChannel>
```

The right half of the BS Signal tab contains the following TCH settings:

Slot Mode

The *Slot Mode* softkey set the mobile station under test to either *Single Slot* or *Multislot* operation. As soon as a call is established the slot mode can no longer be changed and the softkey is disabled (grayed). The *Multislot* setting changes some of the other softkeys in the *BS Signal* tab (see section *Softkey-oriented Version: MS* Multislot on p. 4.135). It will come into effect only if the BS under test is capable of multislot operation (i.e. if it supports HSCSD or GPRS).

Remote control
No separate switchover command. The slot modes are selected implicitly by the keywords `[:SSLot]` or `:MSLot` in the command header.

TCH Level

The *TCH Level* softkey sets the absolute level (in dBm) in the used timeslot and the relative level in all unused timeslots. The unused timeslot level is defined relative to the level in the used timeslot (in dB).

The value range for both levels depends on the RF output selected and of the external attenuation set, see section *Control of Input and Output Signals (Non Signalling)* on page 4.66.

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot
```

RF Channel

The *RF Channel* softkey selects the GSM channel number of the BS traffic channel. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.66 ff. In GSM900 the CMU can use all three sub-bands (P-GSM, E-GSM, R-GSM), so care must be taken that the MS supports the selected *RF Channel.*

Remote control

```
CONFigure:BSSignal[:CSWitched][:TCH]:CHANnel  <Channel>
```

Timeslot

The *Timeslot* softkey determines the timeslot for the BS traffic channel.

Remote control

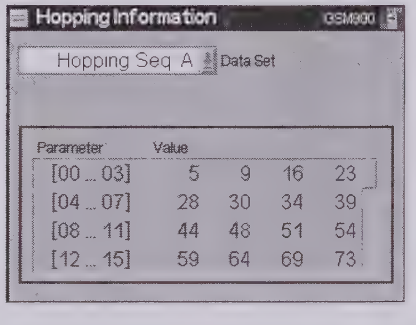
```
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:TIMeslot
<Timeslot>
```

Hopping

The *Hopping* softkey selects a frequency hopping sequence.

Off	Switch off frequency hopping
A, B, C, D	Selection of the hopping sequence referred to as A (or B or C or D)

Pressing the *Hopping* softkey twice opens the *Hopping Information* dialog:



Hopping Seq A — Data Set

Parameter	Value			
[00 ... 03]	5	9	16	23
[04 ... 07]	28	30	34	39
[08 ... 11]	44	48	51	54
[12 ... 15]	59	64	69	73

This dialog displays the current hopping sequences A to D. The four sequences can be selected in the *Data Set* list.

Note: *The hopping sequence can be (re)defined in the table-oriented version of the BS Signal tab while the CMU is in the signalling states Signal Off, Signal On, or Synchronized. See section Table-oriented Version on p. 4.146 ff.*

Remote control

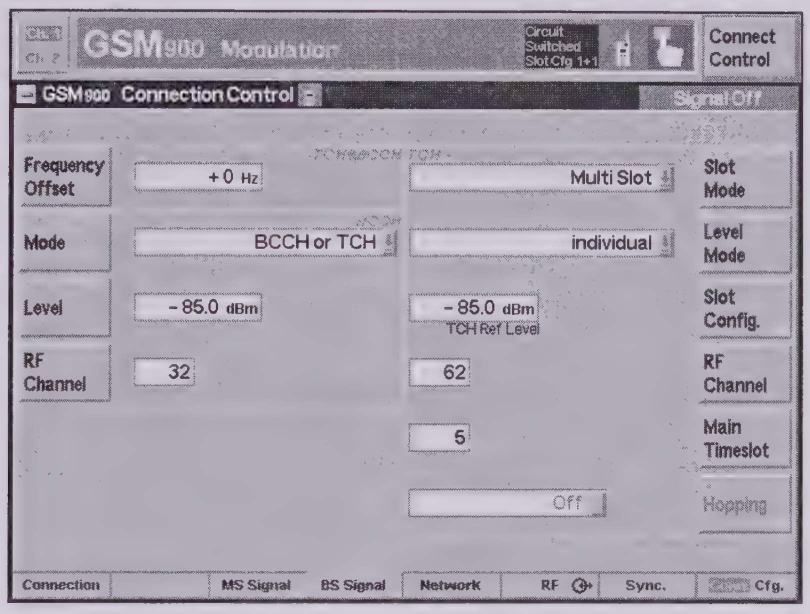
```
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:
                                     FHOPping:SEQuence
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:A
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:B
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:C
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:D
```

Softkey-oriented Version: BS Multislot Mode

The *Slot Mode* of the mobile can be set by means of the *Slot Mode* softkey before a call is established. While *Multislot* mode is selected, frequency *Hopping* is set to *Off* and the softkey-oriented version of the *BS Signal* tab determines

- A *Frequency Offset* by which the RF frequency of the BS traffic and control channel (BCCH) signal is modified
- The transmission *Mode*, *Level* an GSM channel number *(RF Channel)* of the CMU's Broadcast Control Channel (BCCH)
- The definition of the BS signal levels in all timeslots *(Level Mode)*
- The reference level (TCH Ref. Level),
- The *Main Timeslot* used for signalling and its GSM channel number *(RF Channel)*

Connect. Control →



Frequency Offset: +0 Hz

Mode: BCCH or TCH

Level: -85.0 dBm

RF Channel: 32

Slot Mode: Multi Slot

Level Mode: individual

Slot Config.: -85.0 dBm TCH Ref Level

RF Channel: 62

Main Timeslot: 5

Hopping: Off

Fig. 4-74 Connection Control – BS Signal (panel)

The left half of the BS Signal tab contains the BCCH settings described in section *Softkey-oriented Version: BS Single Slot Mode* on p. 4.141 ff. The right half of the BS Signal tab contains the following TCH settings that are not described in section *Softkey-oriented Version: BS Single Slot Mode* on p. 4.141 ff.:

Level Mode

The *Level Mode* softkey determines how the downlink TCH levels are defined if the mobile is in *Multislot* mode:

Used/Unused	All active (used) timeslots are at the same level and all inactive (unused) timeslots are at the same level. The *Used Timeslot Level* and the *Unused Timeslot Level* can be defined by means of the *Slot Config.* softkey or in the table-oriented version of the *BS Signal* or of the *MS Signal* tab; see also *Slot Configuration Editor* on p. 4.136.
Individual	All active (used) timeslots can be set individually and all inactive (unused) timeslots are off (at zero level). The levels of the used timeslots can be defined in the table-oriented version of the *BS Signal* or of the *MS Signal* tab; see also *Slot Configuration Editor* on p. 4.136. They are expressed relative to a *Reference Level* which is defined by means of the *Slot Config.* softkey or in the table-oriented version of the *BS Signal* or of the *MS Signal* tab.

Remote control
`CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe UUN | IND`

Slot Config.

The function of the *Slot Config.* softkey depends on the *Level Mode* setting:

- In the *Used/Unused* level mode, the softkey defines the *Used Timeslot Level* and the *Unused Timeslot Level.*
- In the *Individual* level mode, the softkey sets the *Reference Level* for the individual timeslots.

Pressing the *Slot Config.* softkey twice opens the *Slot Configuration Editor* described on p. 4.136. The *Slot Configuration Editor* determines the levels in all uplink and downlink timeslots.

Remote control
`CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:UUNused`
`CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:INDividual`

RF Channel

The *RF Channel* softkey selects the GSM channel number of the main timeslot. For an overview of GSM channels see section *Control of Input and Output Signals* on page 4.66 ff.

Remote control
`CONFigure:BSSignal[:CSWitched][:TCH]:CHANnel`

Main Timeslot

The *Main Timeslot* softkey determines the timeslot that the MS and the BS/CMU use for signalling. The main timeslot can not be switched off in both the downlink and uplink; see *Slot Configuration Editor* above.

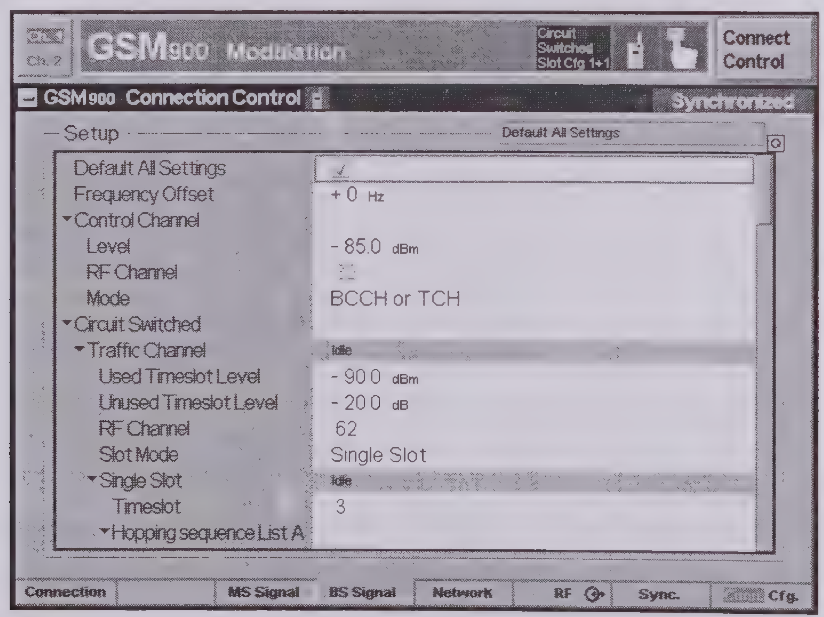
Remote control
`PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot`
`CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot`

Table-oriented Version

The table-oriented version of the *BS Signal* tab contains all BS signal settings of the softkey-oriented version (see sections *Softkey-oriented Version: BS Single Slot Mode* on p. 4.141 and *Softkey-oriented Version: BS Multislot Mode* on p. 4.144). Besides it defines:

- The four *Hopping* sequences A, B, C, and D. The hopping sequences can be defined in the signalling states *Signal On, Signal Off* and *Synchronized*. They are valid if the mobile is in *Single Slot* mode only.

Connect. Control →



Default All Settings	✓
Frequency Offset	+ 0 Hz
▾Control Channel	
Level	- 85.0 dBm
RF Channel	[illegible]
Mode	BCCH or TCH
▾Circuit Switched	
▾Traffic Channel	Idle
Used Timeslot Level	- 90.0 dBm
Unused Timeslot Level	- 20.0 dB
RF Channel	62
Slot Mode	Single Slot
▾Single Slot	Idle
Timeslot	3
▾Hopping sequence List A	

Fig. 4-75 Connection Control – BS Signal (table)

The following settings are not provided in the softkey-oriented versions of the *BS Signal* tab (see sections *Softkey-oriented Version: BS Single Slot Mode* on p. 4.141 and *Softkey-oriented Version: BS Multislot Mode* on p. 4.144 ff.).

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *BS Signal* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
–

Hopping sequence List ...

The table section *Hopping Sequence List...* configures the four frequency hopping sequences A, B, C, and D. Configured hopping sequences can be selected via the *Hopping* softkey in the signalling state *Call Established* (see section *Softkey-oriented Version: BS Single Slot Mode* on page 4.141).

In GSM networks, frequency hopping is primarily used for error protection in the radio transmission path. It consists of periodically switching over the transmission channels (except BCCH) to other carrier frequencies. The frequency changes after each radio frame so that the dwell time on each carrier frequency is 4.615 ms ("slow" frequency hopping).

Frequency hopping is controlled by the network: The BTS transfers a hopping sequence (hopping list) to the mobile station. From this list, the mobile station calculates the radio frequency channel for each TDMA frame number according to an algorithm described in GSM 05.02.

Four standard hopping lists *A, B, C,* and *D* are defined as default sequences, see command description in chapter 6. All four lists can be modified by entering up to 64 channel numbers. If a shorter list is desired, *Off* can be entered for the unused channel numbers.

Remote control

```
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:
                                        FHOPping:SEQuence
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:A
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:B
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:C
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:D
```

Network Parameters (Connection Control – Network)

The *Network* tab defines various parameters of the network that the CMU reports to the mobile station. Some functions of the menu depend on the *Main Service (Circuit Switched* or *Packet Data (GPRS)* operating mode) and most parameters can no longer be set after the *Call Established* signalling state is reached. As a consequence, settings may be disabled or even hidden in some operating modes of the CMU/MS test system. Exact information is provided in the command description in chapter 6 of this manual.

The present chapter describes the parameters related to circuit switched operation of the mobile phone. Tests in *Packet Data (GPRS)* mode require option CMU-K42. They are described in section Network Parameters (Connection Control – Network) on p. 4.165 ff.

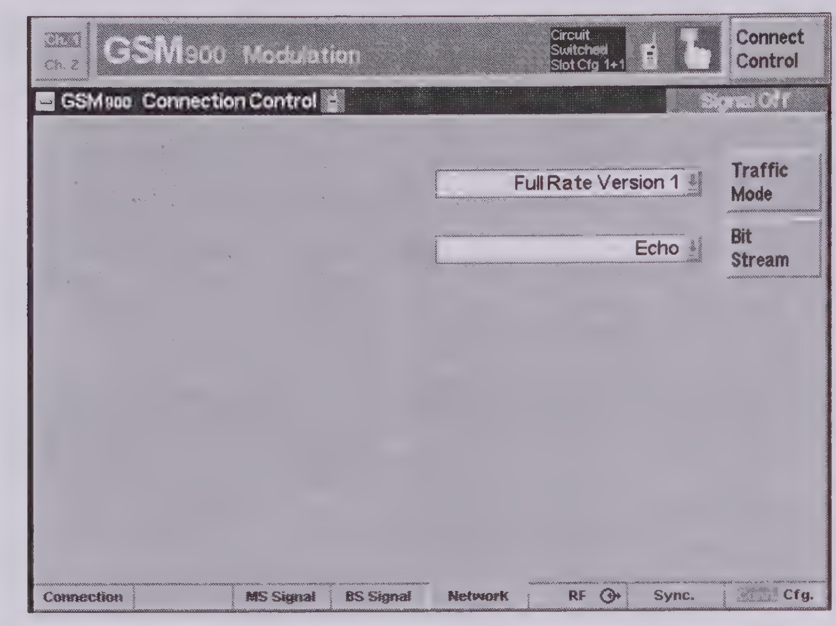
The CMU provides a softkey-oriented version of the *Network* tab and a table-oriented version with extended functionality. The *Network* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-oriented Version

The softkey-oriented version of the *Network* tab selects the following traffic channel parameters:

- The channel coding and transmission rate *(Traffic Mode)*
- The bit pattern that the CMU transmits to the MS *(Bit Stream)*

Connect. Control →



Traffic Mode: Full Rate Version 1

Bit Stream: Echo

Fig. 4-76 Connection Control – Network parameters (panel)

Traffic Mode

The *Traffic Mode* softkey determines the speech or data channel coding and the transmission rate in the traffic channels:

Full Rate Version 1	Use of standard full-rate coding
Full Rate Version 2	Enhanced Full Rate
Half Rate Version 1	Half-rate coding
Full Rate Data 4800	*Full-rate coding with fixed transmission rate in baud*
Full Rate Data 9600	
Full Rate Data 14400	
Half Rate Data 2400	*Half-rate coding with fixed transmission rate in baud*
Half Rate Data 4800	

Note: *A transmission mode can only be selected if the connected mobile station is equipped with the appropriate speech coder. If this is not the case, the CMU automatically sets the default speech coder (Full Rate Version 1).*

The following traffic modes are available only if *Signalling Channel* is set to *NONE* (see p. 4.151). They can be used to perform *Receiver Quality* tests specific to packet-data channels and to measure the Data Block Error Rate (DBLER).

CS1	Coding according to coding scheme 1 *(CS-1)* specified for GPRS.
...	
CS4	Coding scheme 4 *(CS-4)* specified for GPRS.
MCS1	Modulation and coding scheme 1 *(MCS-1)* specified for EGPRS.
...	
MCS9	Modulation and coding scheme 9 *(MCS-9)* specified for EGPRS.

The four coding schemes CS-1 to CS-4 are defined for the GPRS packet-data traffic channels (PDTCH). For most packet control channels, coding scheme CS-1 is used. All coding schemes CS-1 to CS-4 are mandatory for MSs supporting GPRS.

The nine modulation and coding schemes MCS-1 to MCS-9 are defined for the EGPRS packet data traffic channels. For all EGPRS packet control channels the corresponding

GPRS control channel coding is used. Mobiles supporting EGPRS shall support MCS-1 to MCS-9 in downlink and MCS-1 to MCS-4 in uplink.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic
[SENSe]:MSSinfo:TRAFfic?
```

Bit Stream

The *Bit Stream* softkey determines the data transmitted on the traffic channel and the signal path.

Echo	Loop-back with delay. The CMU sends back all data received on the TCH after 50 speech frames (Echo). If the CMU does not receive speech data in this operating mode, a bit pattern is automatically sent, producing "silence" in the receiver of the mobile station.
Loopback	Loop-back with minimum delay: The CMU sends back all data received on the TCH after 1 speech frame.
PSR 2E9-1	Transmission of the pseudo random sequence to CCITT O.153
PSR 2E11-1	Transmission of the pseudo random sequence to CCITT O.153
PSR 2E15-1	Transmission of the pseudo random sequence to CCITT O.151
PSR 2E16-1	Transmission of a pseudo random sequence (Polynomial: $x^{16}+x^{5}+x^{3}+x^{2}+1$)
Handset	The CMU sends and receives speech frames that are routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is amplified by 22.5 dB.
Handset Low	The CMU sends and receives speech frames that are routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is not amplified.
Decoder Cal	The speech codec (option CMU-B52) provides a 1 kHz sinewave signal at its analog output. This signal is used for external calibration of the of the analog output paths.
Encoder Cal	The speech codec (option CMU-B52) loops the input signal after digital/analog conversion directly to the analog output. This signal is used for external calibration of the of the analog input paths.
Codec Cal	The CMU sends and receives speech frames that are routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is not amplified. The CMU sends a close loop message to the mobile station to activate an internal test loop.

Receiver Quality measurements require a pseudo random bit sequence to be transmitted on the traffic channel. This sequence can be set independently as *Bit Stream BER* (see p. 4.116); the bit stream set in the *Network* tab is not valid for *Receiver Quality* measurements.

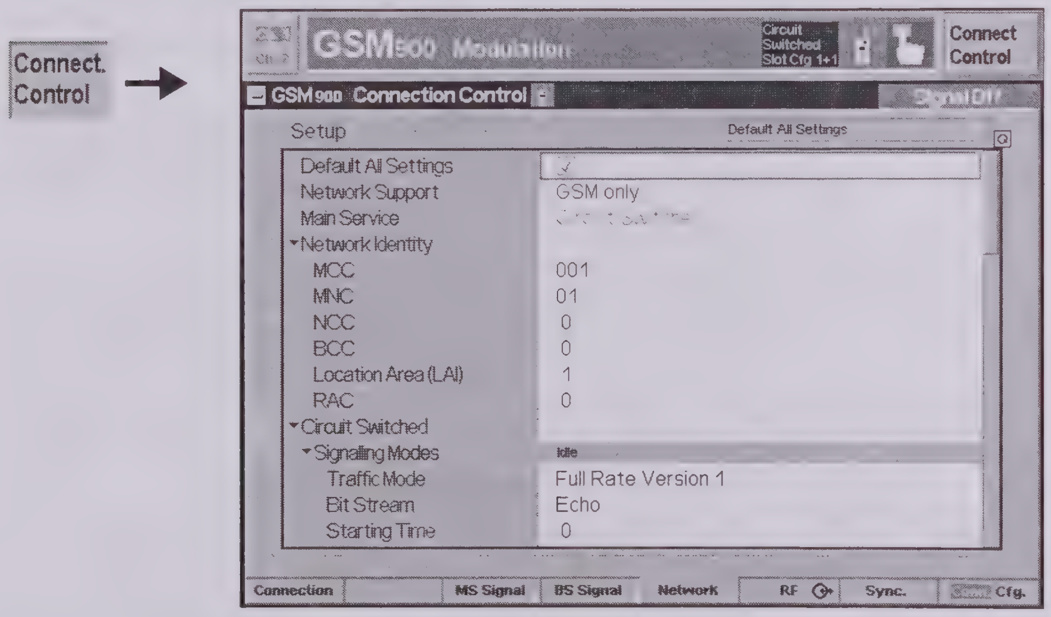
Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:BITStream
PROCedure:NETWork[:CSWitched]:SMODe:BITStream
```

Table-oriented Version

The table-oriented version of the *Network* tab contains all *Network* settings of the softkey-oriented version (see section *Softkey-oriented Version* on p. 4.147). Besides it defines:

- The *Network Support* of the CMU simulating a BS station and the *Main Service*. These network parameters can also be defined in the *Connection* tab; see section *Signalling Control without Signal (State Signal Off)* on p. 4.81.
- The code numbers defining the *Network Identity*
- Configuration parameters for signalling *(Starting Time, Location Update, Default IMSI, Power Change, Signalling Channel, Loop Command)*
- The definition of the parameters of the mobile station that are requested by the CMU during *location update* or when a call is setup *(Requested Mobile Data)*
- *Timeouts*
- Parameters for calculation of the *Advice of Charge*
- *System Parameters*
- The used channels in the neighbor cells *(BA List)*



Default All Settings ✓
Network Support GSM only
Main Service [illegible]
Network Identity
MCC 001
MNC 01
NCC 0
BCC 0
Location Area (LAI) 1
RAC 0
Circuit Switched
Signaling Modes Idle
Traffic Mode Full Rate Version 1
Bit Stream Echo
Starting Time 0

Fig. 4-77 Connection Control – Network parameters (table)

The following settings are not provided in the softkey-oriented version of the *Network* tab (see section *Softkey-oriented Version* on p. 4.147 ff.) or in the *Connection* tab.

Network Identity The field *Network Identity* contains parameters characterizing the radio network:

MCC	3-digit mobile country code, set to 001,
MNC	2-digit mobile network code, set to 01, (3-digit for GSM850 and GSM1900, set to 010)
NCC	Network color code, set to 0,
BCC	Base transceiver station color code, set to 0,
Location Area (LAI)	Location area code, set to 1.

Remote control

```
CONFigure:NETWork:IDENtity:MCC  <MCC>
CONFigure:NETWork:IDENtity:MNC  <MNC>
CONFigure:NETWork:IDENtity:NCC  <NCC>
CONFigure:NETWork:IDENtity:BCC  <BCC>
CONFigure:NETWork:IDENtity:LAC  <LAC>
```

Signalling Modes

The *Signalling Modes* table section determines signalling parameters that the CMU conveys to the mobile station to influence its function (the parameters for CMU signals, on the other hand, are set in the BS-Signal tab, see section RF Signals of the CMU (Connection Control – BS Signal) on p. 4.141 ff.). The parameters refer to:

- *Traffic Mode* and *Bit Stream;* see section *Softkey-oriented Version* on p. 4.147 ff.
- Definition of a *Starting Time* for the channel change and the handover.
- *Location Update*
- Input of a mobile subscriber identity used for the location update *(Default IMSI)*
- *Power Change* mode
- *Signalling Channel*
- Condition for closing the loop in the mobile station *(Loop Command)*

Starting Time

The *Starting Time* field determines a time interval after which the mobile station performs a new registration to the network after a channel, timeslot and fast power change (see *Power Change*). The value 0 frames means that no starting time is used.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:STIMe  <Frames>
```

Location Update

The *Location Update* field determines in which cases the mobile performs a location update:

Always	each time the mobile station is switched on
Auto	only if required

A location update is normally used to signal to the base stations that the mobile station has changed its position. In this case, it is used to report to the CMU that the mobile station is switched on and ready for a call. After a location update of the mobile station, the signalling state *Synchronized* is reached. The parameter *Auto* implies that the attach bit is cleared. The mobile station will then only perform a location update if it does not seem to be registered. This may happen when the SIM card is changed or when the network parameters (e.g. *location area*) are changed in the CMU.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:LOCupdate  ALWays | AUTO
```

Default IMSI

The *Default IMSI* section defines an international mobile subscriber identity (IMSI) which is used to set up the call to the mobile. It consists of:

MCC	3-digit mobile country code
MNC	2-digit mobile network code (3-digit for GSM850 and GSM1900)
MSIN	10-digit mobile subscriber id. No. (9-digit for GSM850 and GSM1900)

The IMSI of the mobile phone must be known before the call can be established. If the IMSI is known and reported to the tester as *Default IMSI,* it doesn't have to be determined during the location update; the call procedure will be faster. For this purpose, the international mobile subscriber identity request must be switched off *(IMSI Request = Off).*

Otherwise, the *Default IMSI* is overwritten by the respective parameters of the mobile station as soon as these are requested and transferred. For this purpose, the international mobile subscriber identity request must be switched on *(IMSI Request = On).*

The default setting for the *Default IMSI* is MCC = 001, MNC = 01, MSIN = 1000000095 (Phase-2 mobile phones). For GSM850 and GSM1900, MNC = 010, MSIN = 100000095.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MCC  <code>
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MNC  <code>
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MSIN <code>
```

Power Change Mode

The *Power Change Mode* controls the power change of the mobile station:

Slow	Slow power change, controlled via SACCH *(slow associated control channel),*
Fast	fast power change, controlled via FACCH *(fast associated control channel).*

Note: *The CMU does not check whether the new power has already been achieved at the end of the command (be careful with remote-control programs).*

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:PCHange  FAST | SLOW
```

Signalling Channel

The *Signalling Channel* field determines which channel is used for signalling:

SDCCH	Signalling via *stand-alone dedicated channel:* Call setup to traffic channel with an extra signalling channel (normal mode in the network), duration 4 s to 6 s
FACCH	Signalling via *fast associated control channel:* Fast call setup with signalling on traffic channel, duration 1 s to 2 s
NONE	Change to the *Call Established* state without signalling. This mode is analogous to *Reduced Signalling* in packet data mode; see *Service Selection* softkey on p. 4.161.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:SCHannel
```

Loop Command

The line *Loop Command* determines in which cases the loop command is sent to the mobile station. Closing of the loop causes the mobile station to send received bits back again. In the case of an open loop, the mobile station does not send back anything. Most but not all mobiles require a test SIM card to enter the loop-back mode.

Enable	If the test set sends a pseudo-random modulation (PSR2E9-1, PSR2E11-1, PSR2E15-1, PSR2E16-1, e.g. for *Receiver Quality* measurement), the loop will automatically be closed. If no pseudo-random modulation is sent *(ECHO, Loopback, Handset)*, the loop will automatically be open.
Disable	The CMU sends no loop command (not even with the bit-error-rate measurement).
BER	The CMU only sends the loop command with the bit-error-rate measurement.

A closed loop is a prerequisite for a receiver quality test (bit-error-rate measurement). However, it is useful even for transmitter measurements, since it permits to obtain a pseudo-random-modulated transmit signal from the mobile in an easy way. If the CMU transmits a pseudo-random modulation, the close loop command also causes a pseudo-random modulation of the signal returned by the mobile station.

Remote control

```
CONFigure:NETWork[:CSWitched]:SMODe:LCOMmand
```

Requested Mobile Data

The field *Requested Mobile Data* determines which signalling parameters of the mobile station are requested and displayed:

IMSI Request	Request of the international mobile subscriber identity *(On)* or no request *(Off)*.
IMEI Request	Request of the international mobile station equipment identity *(On)* or no request *(Off)*.
Authentication Request	Switching the authentication request *On* or *Off*.
Handover Request	Request to determine whether the mobile station can hand over to another GSM radio network (e.g. GSM1800, GSM1900) *(On)* or not *(Off)*. Dual band handover is always possible.

The IMSI request can be switched off if the IMSI of the mobile phone is known and reported to the tester as *Default IMSI* (see above). This speeds up the call setup procedure.

Remote control

```
CONFigure:NETWork[:CSWitched]:REQuest:IMSI   ON | OFF
CONFigure:NETWork[:CSWitched]:REQuest:IMEI   ON | OFF
CONFigure:NETWork[:CSWitched]:REQuest:AUTHenticate   ON | OFF
CONFigure:NETWork[:CSWitched]:REQuest:HANDover   ON | OFF
```

Timeouts

The *Timeouts* field determines timeouts after which an interrupted radio link or an unsuccessful call to the mobile station is aborted:

Radiolink Timeout Mobile	Time period after which a previously established but interrupted connection is dropped by the mobile station – number of missing SACCH blocks in the value range 4, 8, 12, ... 24, ... 64
Radiolink Timeout Testset	Time period after which an existing, but interrupted connection is aborted by the CMU – number of missing SACCH blocks in the value range 4, 5, 6, ... 24, ... 64. In the setting Off, the CMU does not abort the connection; this corresponds to an infinite timeout period
MTC Timeout	Maximum time period in seconds during which the phone is ringing in the case of call to mobile (mobile terminated call). If the handset is not picked up, the CMU returns to the *Synchronized* state. Values from 0 s to 10 s to 60 s can be set. In the Off setting, the number of the mobile station is dialed for an unlimited period of time; this corresponds to an infinite timeout

Timeouts are of particular importance in remote-control mode. For example, the remote-control program will not be able to continue if the keyboard of the mobile station is defective and the call can therefore not be answered by the mobile station.

Remote control

```
CONFigure:NETWork[:CSWitched]:TIMeout:RLINk[:MOBile]   <Time>
CONFigure:NETWork[:CSWitched]:TIMeout:RLINk:TESTset   <Time>
CONFigure:NETWork[:CSWitched]:TIMeout:MTC   <Time>
```

Advice of Charge

Advice of Charge comprises the settings for the advice of charge on the mobile station:

Enable	CMU sends (*On*) or does not send *(Off)* data for the advice of charge to the mobile station,
E1 ... E7	Formulas for calculation of the advice of charge according to GSM specification. Numerical input in the value range 0 to 8191.

Remote control

```
CONFigure:NETWork[:CSWitched]:AOCharge:ENABle  ON | OFF
CONFigure:NETWork[:CSWitched]:AOCharge <Value1>, .. ,<Value7>
```

Slot Offset

Slot Offset defines the DL timeslot that the mobile is to loop back to the uplink main timeslot. The slot offset is counted from the main timeslot number n_{MTS}: A slot offset SO ($-7 \le SO \le +7$) means that the selected DL timeslot no. equals to (n_{MTS} + SO). Moreover, the peridicity of timeslots in the GSM TDMA frame scheme implies that *Slot Offset* settings differing by 8 are equivalent.

The DL timeslot no. (n_{MTS} + SO) is equal to the timeslot number *(TN)* parameter in the CLOSE_Multi-slot_LOOP_CMD (GSM04.14).

Remote control

```
CONFigure:NETWork[:CSWitched]:SOFFset  <Slots>
```

System Parameters

The field *System Parameters* determines system parameters for the radio link:

BS-AG-BLKS-RES	Number of data blocks (access grant channel) reserved for the AGCH access (basic services access grant blocks reserved) in the value range 0 to 7
BS-PA-MFRMS	Interval between two paging requests of the CMU in multiframes (basic service paging blocks available per multiframes) and in the value range 2 to 9
Paging Reorganisation	Mobile does not switch to the idle mode so it can be reached by all services (setting *Off).* In this state, the spurious emission of a mobile can be measured using a spectrum analyzer
Cell Access	Enabling (Not Barred) or disabling (Barred) a radio cell for mobile stations

Barring a radio cell means that the mobile station cannot synchronize to it and cannot perform a location update.

Remote control

```
CONFigure:NETWork:SYSTem:BSAGblkres  <Blocks>
CONFigure:NETWork:SYSTem:BSPamfrms  <Frames>
CONFigure:NETWork:SYSTem:BSPReorganis  ON | OFF
CONFigure:NETWork:SYSTem:CACCess  BARRed | NBARred
```

BA List

The *BA List* field configures the list of used channels in the neighbor cells *(BA list, BCCH allocation list)*. The BA list is of significance for selecting the radio cells of the mobile station. Up to 16 entries are possible in the list (i.e. 16 used channels in 16 neighbor cells).

00 ... 15	Current number of adjacent cell. It is possible to enter either no channel *(Off)* or one of the GSM channels 0 to 1023.
List Sorted	The channel numbers of the BA list are output in increasing order *(On)* or in arbitrary order *(Off).*

Note: *Irrespective of the current GSM band, channel numbers in the range 0 to 1023 can be used to configure the BA list. Each entry is interpreted to denote a GSM channel of the current GSM band corresponding to the active function group.*

Remote control
`CONFigure:NETWork:BAList <Channel1>{, ... ,<Channel15>}`

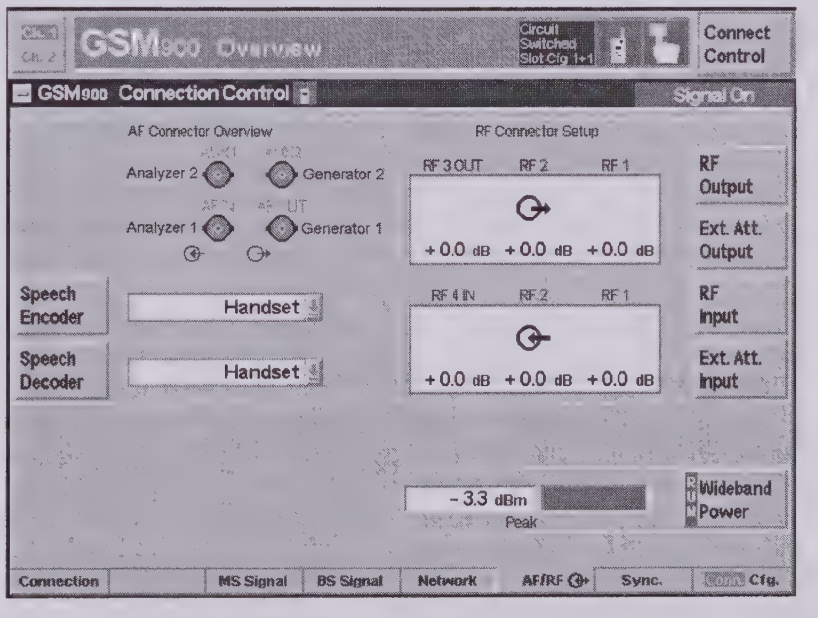
AF/RF Connectors (Connection Control – AF/RF)

The AF/RF → tab selects the connectors for RF and AF signals. This includes the setting of

- The RF input and output at the CMU *(RF Output, RF Input)*
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*
- The input source of the CMU speech encoder and the output destination of its speech decoder

If the *Audio Generator and Analyzer* (option CMU-B41) is not fitted, the speech codec (option CMU-B52) is connected to the 9-pole *SPEECH* (handset) connector on the CMU front panel, see chapter 8 of the CMU operating manual. The *Speech Encoder* and *Speech Decoder* settings are not available.

Connect. Control →



Speech Encoder: Handset
Speech Decoder: Handset

Fig. 4-78 Connection Control – AF/RF connectors

With the exception of the *Speech Encoder* and *Speech Decoder* routing, all functions of this menu are described in the section *GSM400/850/900/1800/1900-MS Non Signalling* on page 4.76.

Speech Encoder

The *Speech Encoder* softkey selects the input source for the CMU speech encoder (option CMU-B52). The following two input sources are available:

Generator	Use the audio generator signal which is also fed to the *AF OUT* connector on the CMU front panel
Handset	Use the signal of the 9-pole *SPEECH* (handset) connector on the CMU front panel

Remote control
`ROUTe:SPENcoder[:INPut] HANDset | GENerator`

Speech Decoder

The *Speech Decoder* softkey selects the output destination for the CMU speech decoder (option CMU-B52). The following output destinations are available:

Handset	Route speech decoder output to the 9-pole *SPEECH* (handset) connector on the CMU front panel
Analyzer	Route speech decoder output to audio analyzer. The standard analyzer input socket *AF IN* is disabled *(Off).*
Analyzer 2	Route speech decoder output to secondary audio analyzer. The standard secondary analyzer input socket *AUX 1* is disabled *(Off).*
Analyzer Both	Route speech decoder output to primary audio analyzer. The standard primary and secondary analyzer input sockets *AF IN* and *AUX 1* are disabled *(Off).*

The primary and secondary audio circuits are described in detail in chapter 4 and 6 of the CMU200/300 operating manual.

Remote control
`ROUTe:SPDecoder[:OUTPut] HANDset | ANALyzer | ANA2 | ABOTh`

AF Connector Overview

The *AF Connector Overview* shows the destination of the input signals fed in via AF IN and AUX 1 and the signals sources for the two audio output connectors AF OUT and AUX 2. The routing of input and output signals does not depend on the *Speech Encoder* settings but is a function of the *Speech Decoder* output destination. In the default configuration *(Speech Decoder = Handset),* the connectors AF IN and AF OUT are used as input and output for the primary audio circuit (Analyzer 1, Generator 1). AUX 1 and AUX 2 are used as input and output for the secondary audio circuit (Analyzer 2, Generator 2). If the *Speech Decoder* output is routed to one of the Analyzers, it replaces the external audio input signal. The corresponding input connector is disabled *(Off).*

Reference Frequency (Connection Control – Synch.)

The *Synch.* tab determines the reference signal for synchronization. This includes

- The selection of internal or external reference frequency
- The output mode for the reference frequency *(F REF OUT 2)*

The functions of this menu are described in the section *GSM400/850/900/1800/1900-MS Non Signalling* on page 4.78.

Options and Extensions

The features described in this section require the installation of additional software options; for a complete list of deliverable options refer to the data sheet.

GPRS Signalling (Option CMU-B42)

General Packet Radio Service (GPRS) is one of the extensions of GSM Phase 2+ that are aimed to increase the obtainable data transfer rate. To reach this objective, GPRS relies upon the following key features:

1. Data transfer is packet oriented. In addition, transmission takes place only when there are actually data packets to be transmitted (Temporary Block Flow, TBF): The radio resources for each subscriber are dynamically allocated. Compared to circuit switched data transfer where a fixed physical radio channel is continuously occupied by one call, the radio resources can be used more efficiently.
2. GPRS is a multislot solution: Up to 8 timeslots per TDMA frame can be allocated to a single subscriber.
3. Redundant data transmission required for error protection can be minimized by using different channel coding schemes CS-1 to CS-4.
4. As a GSM extension, GPRS always works in combination with the existing circuit switched network and does not change or replace any of the existing GSM features. GPRS and GSM services can be used alternately.

The characteristics of the GPRS technology outlined above determine the test requirements for GPRS mobile phones and the GPRS-specific test functionality of the CMU:

1. A GPRS-specific test mode for transmitter tests and a loopback test mode for BER tests has been defined, see *Service Selection* softkey on p. 4.161. The CMU is capable of performing *Receiver Quality* measurements on packet switched data traffic channels (PDTCHs) and evaluates the Data Block Error Rate (DBLER). For background information refer to section *BER Tests of PDTCHs* on p. 4.111.
2. The CMU is able to measure a mobile station that operates in multislot mode (see *Slot Mode* softkey on p. 4.134). In particular, the tester measures and displays the power versus time and performs a limit check in up to 4 consecutive timeslots (see section *P/t Multislot* on p. 4.98 ff.). In contrast to circuit switched operation, no single-slot packet data mode is available.
3. The channel coding schemes CS-1 to CS-4 that a GPRS mobile station under test will use can be set in the *Network* tab of the *Connection Contol* menu *(Coding Scheme;* see section *Network Parameters (Connection Control – Network)* on p. 4.167).
4. The GPRS signalling states and the procedures to set up a data connection are analogous to the corresponding circuit switched functionality. GPRS is an additional mode of the mobile phone so that the circuit switched GSM and the GPRS signalling schemes are largely independent from each other. Any time before a call or a TBF connection is established, the CMU is able to switch over between circuit switched GSM and GPRS mode (see Fig. 4-79 on p. 4.159).

Setup of a Connection (Popup Menu Connection Control – Connection)

The menu group *Connection Control* controls signalling (setup and release of a connection, services, signalling parameters) and configures the inputs and outputs with the external attenuation values and the reference frequency.

The term signalling denotes all procedures that are necessary for setting up and releasing a connection and for controlling the connection in the mobile radio network. In the case of a GSM mobile phone supporting GPRS, both a circuit switched GSM call connection and a GPRS connection for data transfer can be set up. In addition a special GPRS test mode has been defined for production tests of GPRS mobile phones. The five GSM signalling states *Signal Off, Signal On, Synchronized, Alerting, Call Established* of the CMU are therefore complemented by the following GPRS signalling states:

Signal Off	CMU transmits no signal.
Idle	CMU transmits a GSM control channel signal. A GPRS mobile station can detect this signal, synchronize to its timing and frequency and then read the system information. In particular, the MS learns whether the CMU (representing the current cell in a real network) supports GPRS services and can initiate a GPRS attach.
Attach in Progress	Transitory state: GPRS attach is being performed. This step is always initiated by the mobile station under test. The MS identifies itself with its GSM identity (IMSI, Temporary Link Level Identity, TLLI) and indicates its presence to the CMU for the purpose of using GPRS Point to Point (PTP) services. This can be done any time while the CMU is in the *Idle* state.
Detach in Progress	Transitory state: GPRS detach is being performed. Like GPRS attach, the GPRS detach procedure is always initiated by the mobile station under test.
Attached	The mobile station is GPRS-attached. From this state, it is possible to initiate a TBF connection.
Connecting TBF	Transitory state: The CMU attempts to access the *TBF Established* state. Unlike the GPRS attach, the TBF connection must be initiated by the CMU.
TBF Established	The mobile station is in the multislot test mode A or B for GPRS specified in GSM 04.14 (see section 4.160 on p. 4.160). In this mode, it continuously transmits RLC data blocks until the TBF connection is released.

Note: *The* TBF Established *state was specified especially in order to facilitate production tests. Reaching this state is the goal of the CMU's GPRS signalling scheme. The CMU signalling states* Idle, Attached *and* TBF Established *must not be confused with the mobility management states* Idle, Standby *and* Ready *defined in GSM 03.60.*

A number of actions or control commands which can be initiated either by the CMU (e.g. *Signal On, Signal Off*) or by the mobile station (e.g. *MS Attach/Detach)* switch between the different signalling states. In Fig. 4-79 on p. 4.159, dashed lines represent processes initiated by the mobile station.

Activating GPRS The CMU mimics a real GSM base station which may or may not support GPRS. The instrument provides the two *Network Support* modes *GSM* or *GSM + GPRS* that can be selected in the *Network* or in the *Connection* tab of the *Connection Control* menu while the CMU is in the GSM *Signal Off* or *Signal On* state (see *Network Support* softkey on p. 4.83 ff.).

Operating sequence To establish a GPRS connection proceed as follows:

- ➢ In the *Menu Select* menu, select one of the menus in *GSM Signalling* mode.

The *Connection* tab of the *Connection Control* menu is opened. The CMU should be in the signalling state *Signal On*. The *Main Service* softkey is inactive.

- ➢ Press the *Network Support* softkey to select *GSM + GPRS*.
- ➢ Press the *Main Service* softkey (which is now active) to select *Packet Data* and switch over from the circuit switched GSM to the GPRS signalling scheme.

The CMU is now in the GPRS *Idle* state. It reaches the *Attached* state after the MS under test attempts a GPRS attach. The *Connection* tab contains an additional softkey labeled *Service Selection*.

- ➢ Press *Service Selection* and select the GPRS test mode (A or B) appropriate for your test case.
- ➢ To establish a TBF connection proceed as outlined in Fig. 4-79 below and in the following sections.

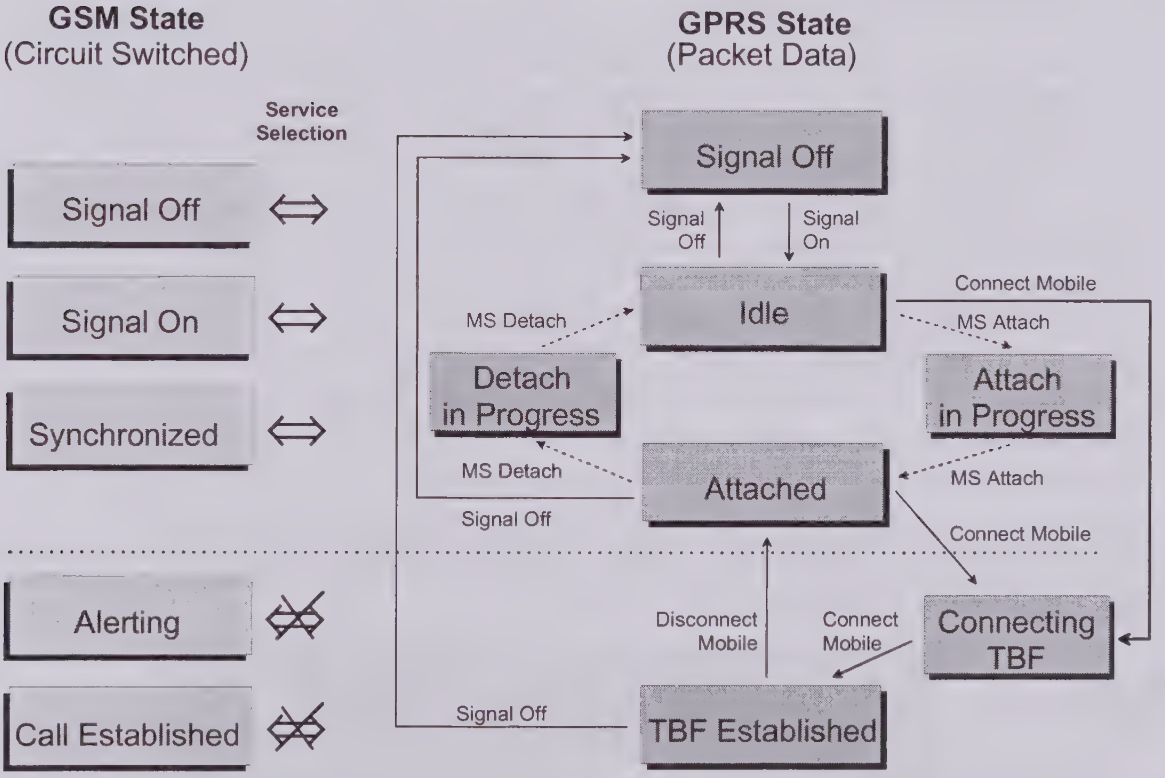


Fig. 4-79 GPRS signalling states

GPRS test mode GPRS mobile tests are to be performed in *TBF Established* mode. This is why the menus for connection setup (*Connection Control – Connection)* appear immediately after the function group and mode *GSM400/850/900/1800/1900-MS Signalling* is activated. The test mode type (A or B, see *Service Selection* softkey on p. 4.161) must be selected before the TBF connection is attempted (i.e. in the *Signal Off*, *Idle* or *Attached* states).

All the tabs in the *Connection Control* menu can be called up any time by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. Pressing the *Escape* key closes the active *Connection Control* menu and re-activates the underlying measurement menu.

Configurations Many applications in *Signalling* mode are only possible or useful in a particular signalling state (for example, many parameters characterizing the MS and its capabilities are announced to the CMU while the MS initiates a GPRS attach, i.e. they are only available for display in the *Attached* and the following signalling states). This implies that many of the *Connection Control* tabs and their functions change with the signalling state. For reference see the *Sig. State* field in the command tables in Chapter 6.

Connection Setup In addition to the five GSM *Connection* tabs[1], seven different *Connection* tabs corresponding to the seven possible GPRS signalling states are available. When a signalling state is reached, the corresponding *Connection* tab is opened automatically. The three tabs *Attach in Progress, Detach in Progress* and *Connecting TBF* indicate transitory states. The remaining four tabs are described in the following sections.

Connection Control – Signal Off

The *Connection (Signal Off)* tab provides information on:

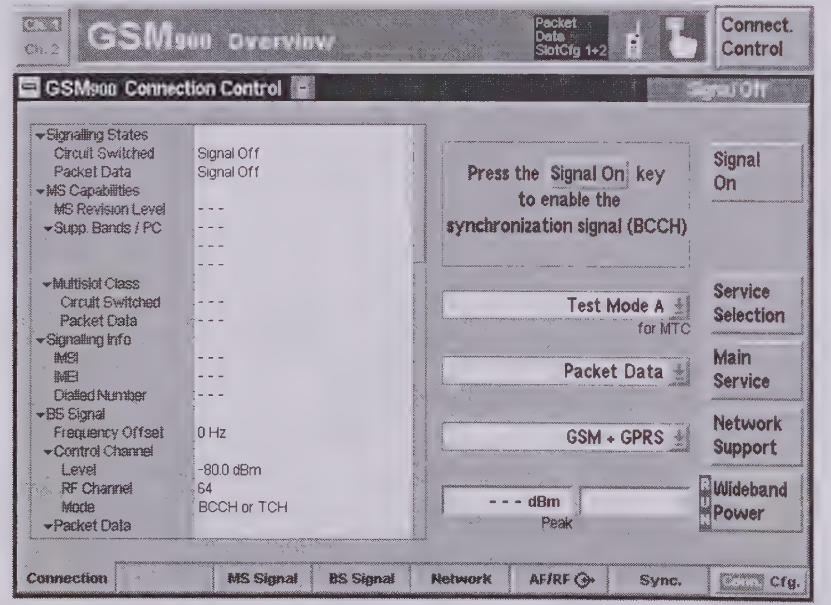
- The current GSM *(Circuit Switched)* and GPRS *(Packet Switched)* signalling states
- The characteristics of the MS under test *(MS Capabilities* and *Signalling Info*, if available, i.e. if a connection was set up before)
- The most important parameters characterizing the frequency and level of the signal sent by the CMU in the state Signal On *(BS Signal)*
- The *Network* code
- Selected AF and RF connectors and external attenuation *(AF/RF ⟶)*
- Status and result of wideband peak power measurement *(Wideband Power)*

Besides, it contains softkeys which lead to other services or signalling states:

- Select another service, e.g. circuit switched mode *(Service Selection)*
- Activate the control channel signal to which the mobile station can synchronize *(Signal On)*

The *Connection (Signal Off)* tab is opened when the function group *GSM-MS Signalling* is selected, or if the control channel signal is switched off *(Signal Off* softkey*)* while the system is in another signalling state. It is replaced by the *Connection (Idle)* menu after the control channel signal on the CMU is switched on (Softkey *Signal On*).

Connect. Control →



Signalling States	
Circuit Switched	Signal Off
Packet Data	Signal Off
MS Capabilities	
MS Revision Level	---
Supp. Bands / PC	--- --- ---
Multislot Class	
Circuit Switched	---
Packet Data	---
Signalling Info	
IMSI	---
IMEI	---
Dialled Number	---
BS Signal	
Frequency Offset	0 Hz
Control Channel	
Level	-80.0 dBm
RF Channel	64
Mode	BCCH or TCH
Packet Data	

Press the Signal On key to enable the synchronization signal (BCCH)

Test Mode A for MTC

Packet Data

GSM + GPRS

--- dBm Peak

Fig. 4-80 Connection Control – Connection (Signal Off)

---

[1] The GSM *Connection* tabs correspond to the *Signalling* tabs in firmware version earlier than V3.05 with a new design corresponding to the five GPRS *Connection* tabs described in this supplement.

The function of the softkeys *Main Service, Network Support,* and *Wideband Power* is described in section *Signalling Control without Signal (State Signal Off)* on page 4.81. The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection Control with Call Established* on p. 4.128 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Header Message A Header Message displayed on top of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Service Selection

The *Service Selection* softkey selects the GPRS test mode:

Test Mode A	The mobile can be commanded to test mode A specified for MS transmitter RF tests; see below. The CMU uses the GPRS signalling scheme.
Test Mode B	The mobile can be commanded to test mode B specified for MS receiver quality (BER) tests; see below. The CMU uses the GPRS signalling scheme.
Reduced Sign.	The mobile can be commanded to the *TBF Established* state without signalling. The reduced signalling mode is analogous to the *Signalling Channel = NONE* mode for circuit switched channels (see p. 4.151). It is a pre-condition for Data Block Error Rate (DBLER) measurements on GPRS channels; see section *BER Tests of PDTCHs* on p. 4.111 f.
Downlink only	The mobile only listens and receives DL data from the CMU; no uplink signal is transmitted. This mode can is suitable for mobile-assisted BER tests.

The *Service Selection* softkey modes is active if the CMU acts as a BTS that supports GPRS; see remark on *Activating GPRS* on p. 4.158 and *Network Support* softkey below. The *Service Selection* softkey is inactive (grayed) unless *Network Support* is set to *GSM + GPRS.*

Remote control

```
PROCedure:SIGNalling:PDATa:ACTion CTMA | CTMB | CRS | CDLonly
[SENSe:]SIGNalling:PDATa:SERVice?
```

The GPRS test modes are specified in GSM 04.14. Any MS must be capable of operating either in test mode A, in test mode B or in both test modes. The CMU can activate a test mode if the MS under test supports this mode.

In test mode A, the MS is commanded to continuously transmit RLC data blocks containing a pseudo random data sequence. In test mode B, the CMU transmits RLC blocks on the downlink containing a pseudo random data sequence; the MS loops back the data received.

The test mode is terminated when the CMU initiates the TBF release *(Disconnect Mobile)* or if the CMU's control channel is switched off *(Signal Off)*. The duration of test mode A can also be limited to a fixed number of PDUs that the MS has to transmit. Test mode configuration parameters are available in the *Network* tab; see description of the *Packet Data* parameters on p. 4.168.

Signal On

The *Signal On* softkey switches on a control channel signal to which the mobile station can synchronize. By switching on the signal, the CMU changes to the signalling state *Idle*.

Remote control

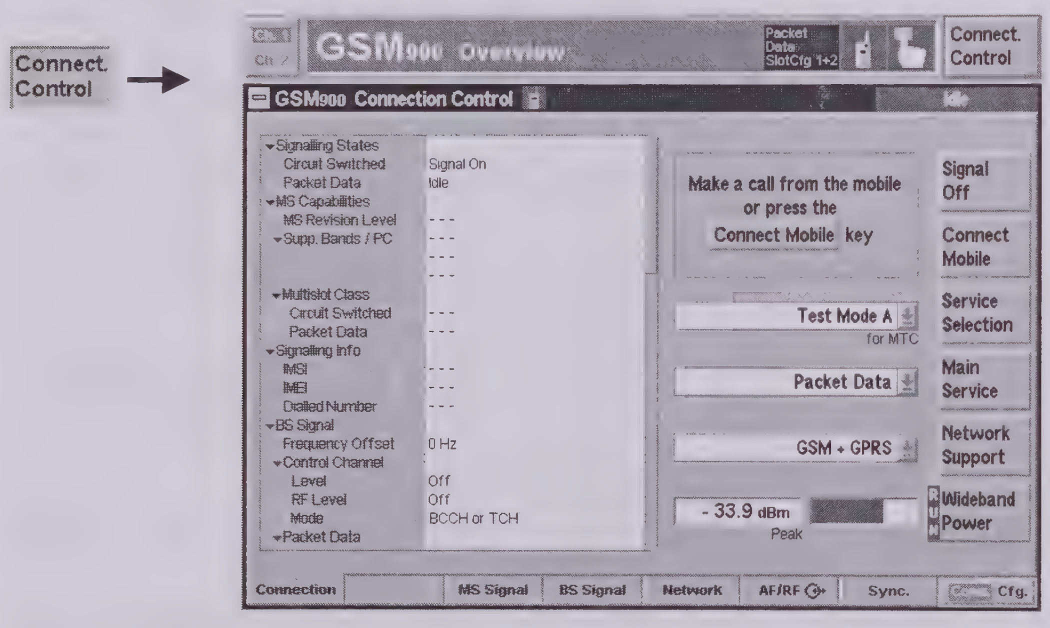
```
PROCedure:SIGNalling:PDATa:ACTion SON
PROCedure:SIGNalling:PDATa:ACTion SON
```

Connection Control – Idle

In addition to the parameter overview, the *Service Selection* softkey and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on page 4.81 ff. the *Connection (Idle)* tab contains the following softkeys which lead to other services or signalling states:

- Switch off the control channel signal for synchronization *(Signal Off)*
- Command the MS to GPRS test mode *(Connect Mobile* -> state *Connecting TBF)*

The *Connection (Idle)* tab is opened after the control channel signal on the CMU is switched on *(Signal On* softkey in the *Connection (Signal Off)* tab). This signal is switched on automatically when the *Signalling* test mode is activated. The *Signal Off* softkey leads back to the *Connection (Signal Off)* menu. *Connection (Idle)* is replaced by the *Connection (Connecting TBF)* and *Connection (TBF Established)* menus after the CMU attempts a TBF connection. It is replaced by the *Connection (Attached)* menu if the mobile station initiates a GPRS attach.



Signalling States
Circuit Switched: Signal On
Packet Data: Idle
MS Capabilities
MS Revision Level: - - -
Supp. Bands / PC: - - -
- - -
- - -
Multislot Class
Circuit Switched: - - -
Packet Data: - - -
Signalling Info
IMSI: - - -
IMEI: - - -
Dialled Number: - - -
BS Signal
Frequency Offset: 0 Hz
Control Channel
Level: Off
RF Level: Off
Mode: BCCH or TCH
Packet Data

Make a call from the mobile or press the Connect Mobile key

Test Mode A
for MTC

Packet Data

GSM + GPRS

- 33.9 dBm
Peak

Fig. 4-81 Connection Control – Connection (Idle)

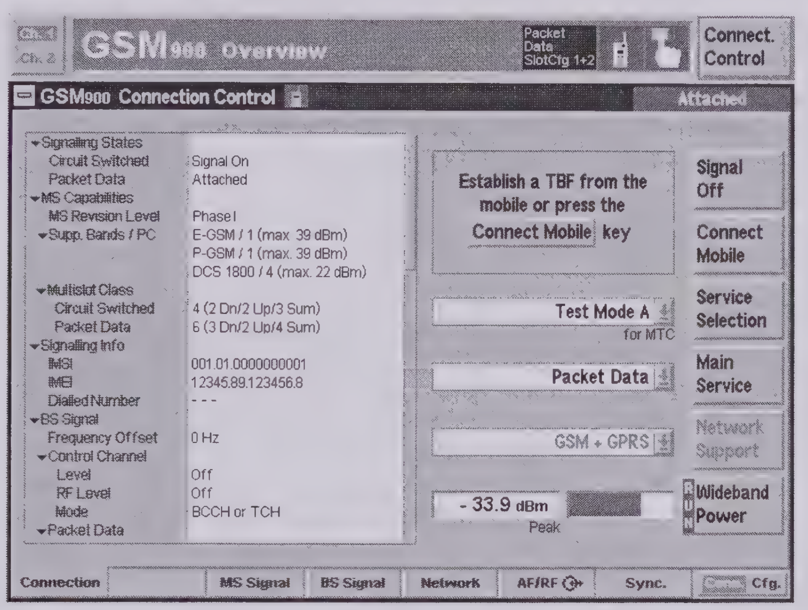
Connection Control – Attached

In addition to the parameter overview, the *Service Selection* softkey and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on page 4.81 ff. the *Connection (Attached)* tab contains the following softkeys which lead to other services or signalling states:

- Switch off the control channel signal for synchronization *(Signal Off)*
- Command the MS to GPRS test mode *(Connect Mobile* -> state *Connecting TBF)*

The *Connection (Attached)* tab is opened after the MS succeeds in establishing a GPRS attach or after the CMU releases a TBF connection *(Disconnect Mobile* softkey in the *Connection (TBF Established)* tab). The Signal Off softkey leads back to the *Connection (Signal Off)* menu.

Connect. Control →



Signalling States	
Circuit Switched	Signal On
Packet Data	Attached
MS Capabilities	
MS Revision Level	Phase I
Supp. Bands / PC	E-GSM / 1 (max. 39 dBm) P-GSM / 1 (max. 39 dBm) DCS 1800 / 4 (max. 22 dBm)
Multislot Class	
Circuit Switched	4 (2 Dn/2 Up/3 Sum)
Packet Data	6 (3 Dn/2 Up/4 Sum)
Signalling Info	
IMSI	001.01.0000000001
IMEI	12345.89.123456.8
Dialled Number	- - -
BS Signal	
Frequency Offset	0 Hz
Control Channel	
Level	Off
RF Level	Off
Mode	BCCH or TCH
Packet Data	

Fig. 4-82 Connection Control – Connection (Attached)

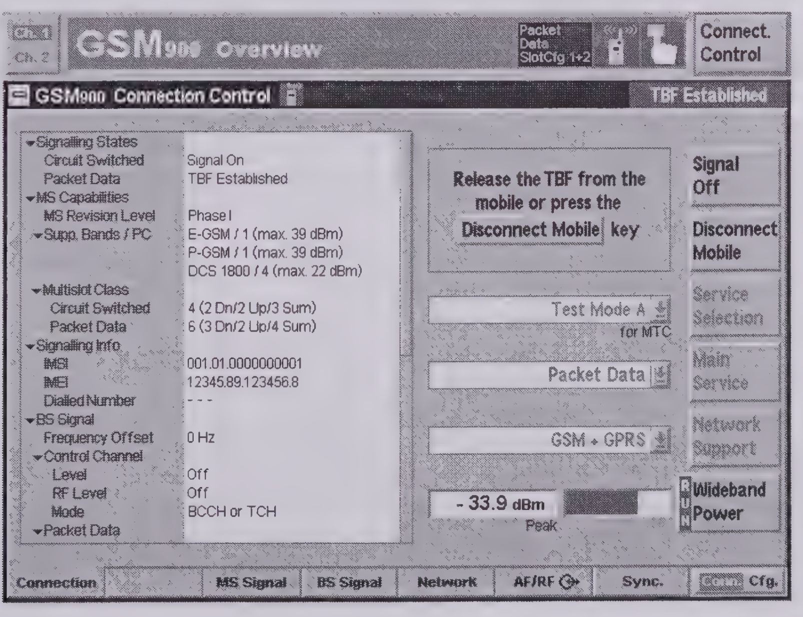
Connection Control – TBF Established

In addition to the parameter overview, the *Service Selection* softkey and the wideband power measurement described in section *Signalling Control without Signal (State Signal Off)* on page 4.81 ff. the *Connection (TBF Established)* tab contains the following softkeys which lead to other services or signalling states:

- Switch off the control channel signal for synchronization *(Signal Off)*
- Terminate the GPRS test mode *(Disconnect Mobile ->* state *Attached)*

The *Connection (TBF Established)* tab is opened after the CMU initiates a TBF connection *(Connect Mobile* softkey in the *Connection (Idle)* or *Connection (Attached)* tabs). The *Signal Off* softkey leads back to the *Connection (Signal Off)* menu. The *Disconnect Mobile* softkey terminates the test mode and leads back to the *Connection (Attached)* menu.

Connect. Control →



Signalling States	
Circuit Switched	Signal On
Packet Data	TBF Established
MS Capabilities	
MS Revision Level	Phase I
Supp. Bands / PC	E-GSM / 1 (max. 39 dBm) P-GSM / 1 (max. 39 dBm) DCS 1800 / 4 (max. 22 dBm)
Multislot Class	
Circuit Switched	4 (2 Dn/2 Up/3 Sum)
Packet Data	6 (3 Dn/2 Up/4 Sum)
Signalling Info	
IMSI	001.01.0000000001
IMEI	12345.89.123456.8
Dialled Number	- - -
BS Signal	
Frequency Offset	0 Hz
Control Channel	
Level	Off
RF Level	Off
Mode	BCCH or TCH
Packet Data	

Fig. 4-79 Connection Control – Connection (TBF Established)

RF Signals of the MS (Connection Control – MS Signal)

The *MS Signal* tab configures the operating mode and the RF traffic channel signal of the MS under test. For packet data transfer the following parameters can be set:

- The *Main Timeslot* and the remaining timeslots *(Slot Configuration)* that are used in downlink and uplink direction
- The RF levels and power control parameters in all timeslots

GPRS Uplink Power Control

Power control of the MS is important for spectral efficiency in the cellular system as well as for the reduction of power consumption of the mobile station. In circuit switched mode, where a continuous two way connection between the BTS and the MS is maintained, **closed loop** power control is used: The BTS measures the received signal level from the MS and dynamically adapts the MS output power in 2-dB steps using a fixed scale of Power Control Levels (PCL).

In **open loop** power control, the path loss in downlink and in uplink is assumed to be identical. If the MS detects a reduction of the received signal level C, it tries to compensate for the changed propagation conditions by increasing its own output power P_{CH} by the same amount: The sum of $P_{CH} + C$ is always kept constant. This fast but inaccurate power control mode is useful at the beginning of a packet transmission.

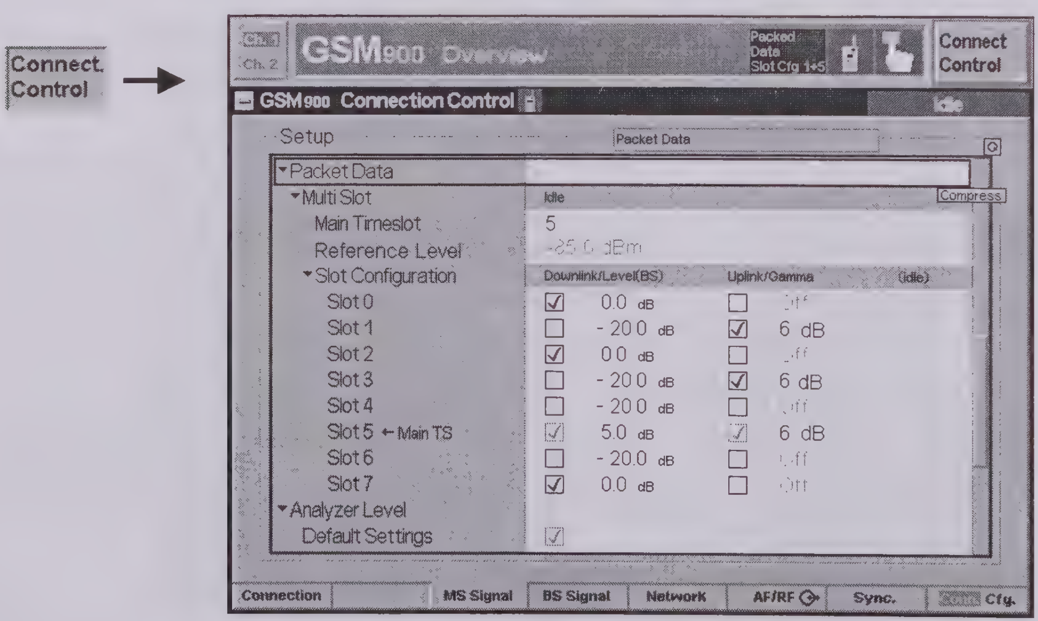
For a discontinuous, packet oriented GPRS connection, a combination of open loop and closed loop power control is used (GSM 11.10). The RF output power P_{CH} on each individual uplink PDCH shall be:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha(C+48), P_{MAX})$$

where Γ_0 is a network-specific constant (+39 dBm for GSM400, GSM850 and GSM900, +36 dBm for GSM 1800 and GSM1900, i.e. the maximum nominal output power of an MS in the network), Γ_{CH} is a power control parameter depending on the MS and channel (analogous to the PCL in circuit switched mode), and α represents a system parameter. Both Γ_{CH} and α are controlled by the BTS. P_{CH} must not exceed the maximum allowed output power in the cell P_{MAX}.

A pure open loop power control is achieved by setting $\alpha = 1$ and keeping Γ_{CH} constant. A closed loop is achieved by setting $\alpha = 0$. The CMU is able to set the individual power control parameters Γ_{CH} for all uplink timeslots whereas the system parameter α is always set to 0.

The CMU provides a softkey-oriented version of the *MS Signal* tab and a table-oriented version with extended functionality. The *MS Signal* hotkey toggles between the two versions if it is pressed repeatedly. For packet data mode, the two tabs provide the same settings.



Setup: Packet Data

Packet Data

Multi Slot: Idle

Main Timeslot: 5

Reference Level: -25.0 dBm

Slot Configuration	Downlink/Level(BS)		Uplink/Gamma	(idle)
Slot 0	☑	0.0 dB	☐	Off
Slot 1	☐	- 20.0 dB	☑	6 dB
Slot 2	☑	0.0 dB	☐	Off
Slot 3	☐	- 20.0 dB	☑	6 dB
Slot 4	☐	- 20.0 dB	☐	Off
Slot 5 ← Main TS	☑	5.0 dB	☑	6 dB
Slot 6	☐	- 20.0 dB	☐	Off
Slot 7	☑	0.0 dB	☐	Off

Analyzer Level

Default Settings: ☑

Fig. 4-83 Connection Control – MS Signal (table)

PMAX

The *PMAX* parameter sets the maximum MS transmitter output power allowed in the cell. The value corresponds to the output power at which the mobile station performs a location update to synchronize to the CMU. It is valid both for circuit switched and for packet data mode.

Remote control

```
CONFigure:MSSignal:CCH:PMAX_
```

Packet Data – Multi Slot

The *Packet Data – Multi Slot* section defines the timeslot configuration in the uplink and downlink:

Main Timeslot	Timeslot used for signalling. The main timeslot can not be switched off in both the downlink and uplink; see *Slot Configuration* below.
PCL (MS)	*PCL (MS)* sets (signalling states < *Call Established)* or changes (signalling states *Call Established)* the MS output power during the connection.
Reference Level	Reference value for the downlink (BS) signal levels. The reference level is calculated from the BCCH level of the BS signal and the downlink power control parameter P0 according to $Reference\ Level = -85\ dBm - P0$; see section *RF Signals of the CMU (Connection Control – BS Signal)* on p. 4.165 f.

Remote control

```
CONFigure:BSSignal:PDATa[:TCH]:MSLot:MTIMeslot
CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONFig
[SENSe:]BSSignal:PDATa[:TCH]MSLot:RLEVel?_
```

Slot Configuration

Table of all used and unused timeslots (GSM timeslots 0 to 7) in the downlink and the uplink. The *Main Timeslot* is always active in both the downlink and uplink direction. The boxes enable (if checked) or disable the other timeslots.

Level (BS)	RF levels in the individual downlink timeslots (RF signal transmitted by the BS/CMU) relative to the *Reference Level* indicated above the *Slot Configuration* table and in the *BS Signal* tab (see section see section *RF Signals of the CMU (Connection Control – BS Signal)* on p. 4.165 f.).
Gamma	Channel-specific power control parameter Γ_{CH} in dB; see note on GPRS power control above

Note: *The number of downlink and uplink channels must be compatible with the multislot class of the MS under test; see* Table 4-10 on p. 4.129.

Remote control

```
CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONFig
PROCedure:SIGNalling:PDATa[:TCH]:MSLot:BS:SCONFig
CONFigure:BSSignal:PDATa[:TCH]:MSLot:SCONFig
```

RF Signals of the CMU (Connection Control – BS Signal)

The *BS Signal* tab configures the RF signals of the CMU (which simulates a base station transmitting a GSM control and traffic channel signal), selects a frequency offset, the frequency hopping scheme and the traffic channel data. For multislot packet data transfer, the downlink (BS signal) and uplink (MS signal) signal configuration is defined in a common table, so the *BS Signal* tab provides many of the settings that are also available in the *MS Signal* tab. The following additional packet data parameters can be set:

- The downlink power control parameter *(P0)*
- The *RF Channel* that the CMU will use for packet data transfer

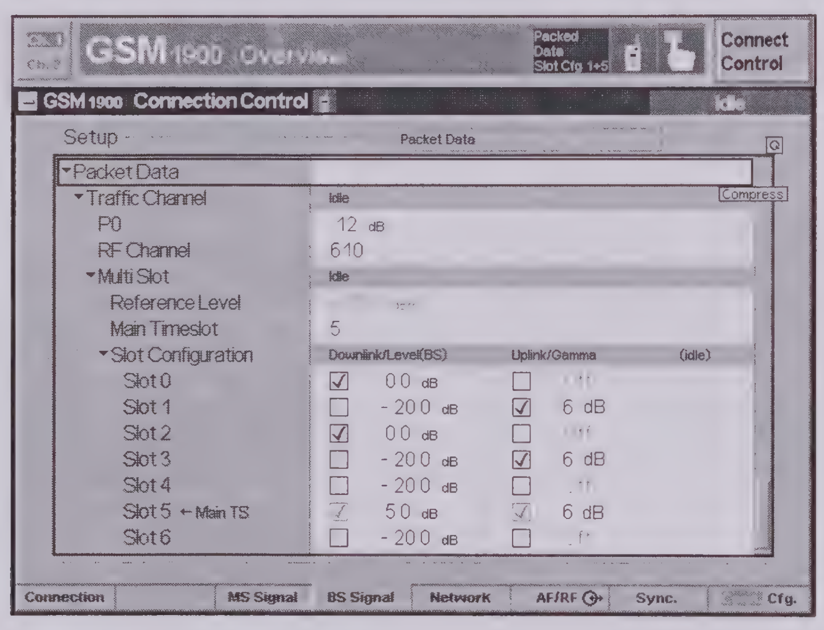
GPRS Downlink Power Control

A BTS can use downlink power control to reduce its output power. Downlink power control relies on a reduction of the PDCH power relative to the BCCH power. This power reduction is defined in terms of a power control parameter P0 which can be specific to a particular MS in the network (power control mode A) or the same for all MS with a TBF established on the same PDCH (power control mode B). For details refer to GSM 05.08 and GSM 04.60.

The P0 parameter can be selected for the BS Signal transmitted by the CMU. The CMU also uses this parameter and its BCCH level to calculate the *Reference Level* for all individual downlink channels in a GPRS multislot configuration.

The CMU provides a softkey-oriented version of the *BS Signal* tab and a table-oriented version with extended functionality. The *MS Signal* hotkey toggles between the two versions if it is pressed repeatedly. For packet data mode, the two tabs provide the same settings.

Connect. Control →



Packet Data			
Traffic Channel	Idle		
P0	12 dB		
RF Channel	610		
Multi Slot	Idle		
Reference Level			
Main Timeslot	5		
Slot Configuration	Downlink/Level(BS)	Uplink/Gamma	(idle)
Slot 0	☑ 0.0 dB	☐	
Slot 1	☐ -20.0 dB	☑ 6 dB	
Slot 2	☑ 0.0 dB	☐	
Slot 3	☐ -20.0 dB	☑ 6 dB	
Slot 4	☐ -20.0 dB	☐	
Slot 5 ← Main TS	☑ 5.0 dB	☑ 6 dB	
Slot 6	☐ -20.0 dB	☐	

Fig. 4-84 Connection Control – BS Signal (table)

Packet Data – Traffic Channel The *Packet Data – Traffic Channel* section defines the power control parameter P0 and the RF (GSM) channel that the CMU will use for data transfer:

P0	Downlink power control parameter P0; see background information at the beginning of this section
RF Channel	GSM channel that the CMU will use for packet data transfer

Remote control

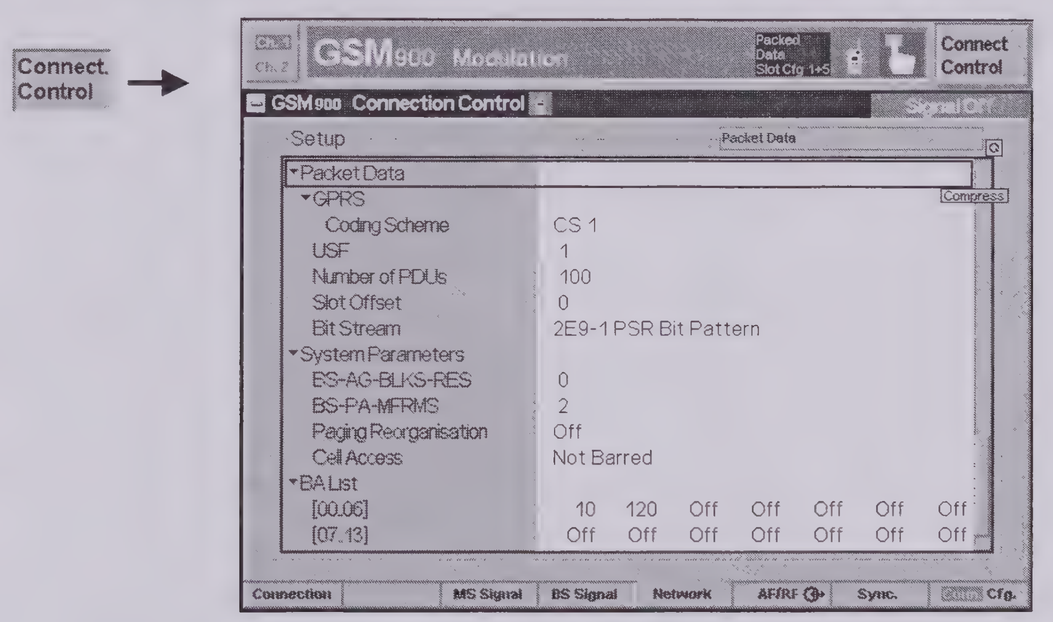
```
CONFigure:BSSignal:PDATa[:TCH]:MSLot:PZERo
CONFigure:BSSignal:PDATa[:TCH]:MSLot:CHANnel
```

The remaining settings are described in section *RF Signals of the MS (Connection Control – MS Signal)* on p. 4.164 ff. The relationship between the table-oriented *BS Signal* tab and its softkey-oriented counterpart is analogous the *MS Signal* tab.

Network Parameters (Connection Control – Network)

The *Network* tab defines various parameters of the network that the CMU reports to the mobile station. The following settings are GPRS-specific and available with option CMU-K42, *GPRS Software Extension*, only:

- Capability of the network: GSM only or GSM + GPRS *(Network Support)*
- Routing Area Code *(RAC)*
- GPRS and EGPRS *Coding Scheme*
- Parameters of the GPRS test modes *(USF, Number of PDUs, Slot Offset, Bit Stream)*



Packet Data							
GPRS							
Coding Scheme	CS 1						
USF	1						
Number of PDUs	100						
Slot Offset	0						
Bit Stream	2E9-1 PSR Bit Pattern						
System Parameters							
BS-AG-BLKS-RES	0						
BS-PA-MFRMS	2						
Paging Reorganisation	Off						
Cell Access	Not Barred						
BA List							
[00..06]	10	120	Off	Off	Off	Off	Off
[07..13]	Off	Off	Off	Off	Off	Off	Off

Fig. 4-85 Connection Control – Network

Network Support The *Network Support* parameter is to report to the MS under test whether or not the CMU currently supports GPRS; see *Network Support* softkey on p. 4.83.

Remote control
`CONFigure:NETWork:NSUPport GSM | GGPR`

Service Selection The *Service Selection* parameter selects GSM or GPRS operation of the MS under test. It is equivalent to the *Service Selection* softkey described on p. 4.161.

Remote control
`[:SENSe:]NETWork:MSERvice`

Network Identity The *Network Identity* section contains parameters characterizing the radio network (see also section Network Parameters (Connection Control – Network) on p. 4.147 ff. One of them is specific to the packet data mode:

RAC	Routing Area Code, set to 0. The RAC identifies the routing area within a location area.

Remote control
`CONFigure:NETWork:IDENtity:RAC <RAC>`

Packet Data

The *Packet Data* section contains parameters defining the traffic data channel coding schemes and the GPRS test mode (see *Service Selection* softkey on p. 4.161):

Coding Scheme	Selection of the coding schemes for traffic data channels: Coding schemes *CS-1* to *CS-4*. These coding schemes can be used to establish a TBF connection with full signalling; they are independent from the reduced signalling coding schemes selected via *Traffic Mode* (see p. 4.148). for GPRS
PC Meas. Chan.	Channel type (BCCH or PDCH) that the mobile uses to determine the received signal strength and quality. The PC Meas. Channel parameter corresponds to the GPRS power control parameter *PC_MEAS_CHAN* in the system information SI 13 Rest Octets (GSM 04.18).
USF	Update State Flag to be set in the blocks transmitted to the MS in GPRS test mode.
Extend. Dyn. Alloc.	Enable or disable Extended Dynamic Allocation of the mobile. Extended dynamic allocation is an optional medium access mode (3GPP TS 04.60). With the *Auto* setting the CMU checks whether the mobile supports Extended Dynamic Allocation by evaluating the *GPRS Extended Dynamic Allocation* message received during the GPRS Attach. Extended Dynamic Allocation is enabled only if the mobile supports this feature.
Number of PDUs	Number of Protocol Data Units (PDUs) that the MS is to transmit in the uplink during GPRS test mode A.
Slot Offset	Timeslot (no. 0 to 7) that is to be taken as the first downlink timeslot when the MS is in multislot operation (downlink timeslot offset parameter in the GPRS_TEST_MODE_CMD).
Testmode with ACK	Enable or disable the operating mode where the mobile periodically transmits a PACKET_UPLINK_ACK_NACK message (GSM 04.60) while it is in test mode B.
Bit Stream	Bit pattern (pseudo random sequence) that the CMU transmits to the MS in GPRS test mode.

Remote control

```
CONFigure:NETWork:PDATa:GPRS:CSCHeme  <Mode>
CONFigure:NETWork:PDATa:USF  <USF>
CONFigure:NETWork:PDATa:NOPDus  <Number>
CONFigure:NETWork:PDATa:SOFFset  <Offset>
CONFigure:NETWork:PDATa:BITStream  <Mode>
PROCedure:NETWork:PDATa:BITStream  <Mode>
```

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5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of GSM remote control commands. Remote control can be described in terms analogous to the ones used in chapter 3 for the classification of menus and settings for the graphical user interface. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure of the GSM Function Groups

Chapter 6 of this manual gives a description of all GSM remote control commands, including their parameters, as well as the default values and ranges of all numerical parameters.

Function group and mode

The commands for the function groups *GSM400-MS GSM850-MS, GSM900-MS, GSM1800-MS* and *GSM1900-MS* are largely identical, however, the ranges of numerical values and some default settings may not coincide. In such cases, the numerical values are explicitly quoted for all function groups.

Commands for the two modes *Signalling* and *Non Signalling* are listed separately although many of them have the same syntax. The commands for the measurement groups `WPOWer`, `NPOWer`, `POWer:SLOT`, `POWer:XSLot`, `POWer:FRAMe`, `POWer:MSLot`, `MODulation`, and `SPECtrum` are identical in both test modes, so they are reported only once.

Addressing

The CMU uses extended addressing: The instrument is assigned a primary address while each function group and test mode is identified via a secondary address. This allows the same remote commands to be used in several function groups and modes:

```
ibwrt(h_GSM900MS_SIG, "INITiate:POWer")
ibwrt(h_GSM1800MS_SIG, "INITiate:POWer")
ibwrt(h_GSM900MS_NSIG, "INITiate:POWer")
```

provided that the variables `h_GSM900MS_SIG` etc. have been appropriately defined, see program examples in chapter 7.

The remote control commands for first `(SYST:COMM:GPIB:ADDR)` and secondary `(SYST:REM:ADDR:SEC)` addressing are described in the CMU operating manual. The `SYST:REM:ADDR:SEC` command uses the following names to address the GSM network tests described in this manual:

GSM400MS_NSig,	*GSM400MS_Sig,*
GSM850MS_NSig,	*GSM850MS_Sig,*
GSM900MS_NSig,	*GSM900MS_Sig,*
GSM1800MS_NSig,	*GSM1800MS_Sig,*
GSM1900MS_NSig,	*GSM1900MS_Sig.*

Order of commands

The commands are arranged to form groups belonging to the same measurement or the same type of configurations. These groups are identified by the second-level keyword (as in `POWer`). Applications belonging to a measurement group (see chapter 5 of the CMU operating manual) are identified by the third-level keyword of each command (as in `SPECtrum:MODulation`). Chapter 6 is organized as follows:

- General configurations in the *Non Signalling* mode: `LEVel`, `TRIGger`, `RFANalyzer`, `RFGenerator`, `INPut`, `OUTPut`, `CORRection:LOSS`, `DM:CLOCk`

- Measurement groups *(Non Signalling* mode): `POWer[:NORMal]...`, `POWer:MPR`
- Measurement groups (identical in *Non Signalling* and *Signalling* mode `(WPOWer, NPOWer, POWer:SLOT, POWer:XSLot, POWer:FRAMe, POWer:MSLot, MODulation..., SPECtrum...)`
- Measurement groups *(Signalling* mode): `POWer[:NORMal]...`, `POWer:ABURst...`, `POWer:MPR`, `POWer:PCL`, `RXQuality...`
- General configurations and signalling in the *Signalling* mode `(LEVel, TRIGger, SIGNalling, HANDover, MSSignal, BSSignal, NETWork, INPut, OUTPut, CORRection:LOSS, DM:CLOCk)`
- GPRS signalling (with option CMU-K42)

The structure of chapter 6 differs from chapter 4 *(Functions and their Application)* where the measurements are presented first and special configurations are reported at the end of each signalling mode section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. Lists of all commands (by function and alphabetical) are annexed to chapter 6.

SCPI Conformity In view of the particular requirements of GSM measurements not all commands could be taken from the SCPI standard. However, the syntax and structure of all commands is based on SCPI rules. For a detailed description of the SCPI standard refer to chapter 5 of the CMU operating manual.

Remote Control All commands may be used for control of the CMU via GPIB and serial (RS-232) interface.

Measurement Control

The commands in the measurement groups `WPOWer`, `NPOWer`, `POWer...`, `MODulation...`, `SPECtrum...`, and `RXQuality...` have an analogous structure and syntax. The measurements are controlled according to common concepts which are explained in detail in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to GSM-MS measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. Most measurement objects correspond to a measurement group or application in manual control. For GSM measurements, the following measurement objects are defined:

Table 5-1Measurement objects in Signalling and Non Signalling mode

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
`WPOWer`	*Wideband Power* softkey (wide-band peak power measurement).	`WPOWer`	*Wideband Power* softkey (wide-band peak power measurement).

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
`NPOWer`	No equivalent in manual control. Narrow-band power.	`NPOWer`	No equivalent in manual control. Narrow-band power.
`POWer[:NORMal][:GMSK]` `POWer[:NORMal]:EPSK`	*P/t Norm. GMSK* *P/t Norm. 8PSK* Burst power as a function of time.	`POWer[:NORMal][:GMSK]`	*P/t Norm. GMSK* *P/t Norm. 8PSK* Normal burst power as a function of time.
`POWer:MSLot`	*P/t Multislot* Burst power vs. time in up to 4 consecutive timeslots (GMSK or 8PSK modulation).	`POWer:MSLot`	*P/t Multislot* Burst power vs. time in up to 4 consecutive timeslots (GMSK or 8PSK modulation).
`POWer:MPR`	No equivalent in manual control Combined power and modulation measurement which should be used if scalar modulation results are needed while a power measurement is running.	`POWer:MPR`	No equivalent in manual control Combined power and modulation measurement which should be used if scalar modulation results are needed while a power measurement is running.
`POWer:SLOT`	*P/Slot Graph* Average burst power in 8 consecutive timeslots.	`POWer:SLOT`	*P/Slot Graph* Average burst power in 8 timeslots of a TDMA frame.
`POWer:XSLOt`	*P/Slot Table* Average burst power in up to 512 consecutive timeslots.	`POWer:XSLOt`	*P/Slot Table* Average burst power in up to 512 consecutive timeslots.
`POWer:FRAMe`	*P/Frame* Average burst power in a particular timeslot in 128 consecutive frames.	`POWer:FRAMe`	*P/Frame* Average burst power in a particular timeslot in 128 consecutive frames.
		`POWer:PCL`	Average burst power as a function of the PCL of the mobile phone on three or seven different channels.
		`POWer:ABURst[:GMSK]`	*P/t Access GMSK* Power of single access burst as a function of time. No 8PSK modulation available.
`MODulation[:PERRor][:GMSK]`	No equivalent in manual control Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset.	`MODulation[:PERRor][:GMSK]`	No equivalent in manual control Fast phase and frequency error measurement excluding the I/Q imbalance and origin offset

Non Signalling		Signalling	
Meas. Object	**Measurement group / Application**	**Meas. Object**	**Measurement group / Application**
`MODulation:XPERror [:GMSK]`	*Ext. Phase Err. GMSK* Extended phase and frequency error measurement including the I/Q imbalance and origin offset.	`MODulation:XPERror [:GMSK]`	*Ext. Phase Err. GMSK* Extended phase and frequency error measurement including the I/Q imbalance and origin offset.
`MODulation:OVERview :EPSK`	*Overview 8PSK* 8PSK scalar modulation parameters including statistical evaluation.	`MODulation:OVERview :EPSK`	*Overview 8PSK* 8PSK scalar modulation parameters including statistical evaluation.
`MODulation:EVMagnitude:EPSK`	*EVM 8PSK* Error vector magnitude in 8PSK modulation.	`MODulation:EVMagnitude:EPSK`	*EVM 8PSK* Error vector magnitude in 8PSK modulation.
`MODulation:PERRor :EPSK`	*Phase Error 8PSK* Phase error in 8PSK modulation.	`MODulation:PERRor :EPSK`	*Phase Error 8PSK* Phase error in 8PSK modulation.
`MODulation:MERRor :EPSK`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation.	`MODulation:MERRor :EPSK`	*Magn. Error 8PSK* Magnitude error in 8PSK modulation.
`SPECtrum:MODulation [:GMSK]` `SPECtrum:MODulation EPSK`	*Modulation GMSK* *Modulation 8PSK* Off-carrier power due to the modulation.	`SPECtrum:MODulation [:GMSK]`	*Modulation GMSK* Off-carrier power due to the modulation.
`SPECtrum:SWITching [:GMSK]` `SPECtrum:SWITching EPSK`	*Switching GMSK* *Switching 8PSK* Off-carrier power due to the switching transients.	`SPECtrum:SWITching [:GMSK]`	*Switching GMSK* Off-carrier power due to the switching transients.
–		`RXQuality:BER<nr>,` `RXQuality:BAVerage`	*BER* *BER Average* Receiver quality measurements, i.e. measurement of the bit error rate and the residual bit error rate, with limit check.

The measurement objects in Table 5-1 are complemented by groups of commands used to retrieve results that are automatically provided by the mobile station (e.g. the receiver parameters reported by the mobile phone). These command groups do not represent real measurements; they consist of queries only. For an overview, see the list of remote control commands at the end of chapter 6.

Measurement Statistics

The *repetition mode* defines how many evaluation periods are measured if the measurement is not stopped explicitly (measurement control commands `STOP...`, `ABORT...`) or by a limit failure. With remote control the three repetition modes *Single Shot, Continuous* and *Counting* are available (*Counting* is not available in manual control, see chapter 3).

In `POWer`, `MODulation`, and `SPECtrum` measurements, different traces corresponding to the result in the current period, the maximum, minimum, or average evaluated over a set of periods are determined within one measurement. The four results can be queried independently.

Table 5-2 Repetition mode in remote control

<table>
<tr><th>Setting</th><th>Description</th><th>Command</th></tr>
<tr><td>Statistic Count</td><td>Integer number of evaluation periods forming one statistics cycle. An evaluation period is equal to a burst length (<code>POWer | MODulation | SPECtrum</code>) or a frame (<code>RXQuality</code> measurements).
The statistic count is set together with the measured quantity.</td><td><code>CONFigure:<meas_obj>:CONTrol SCALar | ARRay, 1 ... 1000 | NONE (<meas_obj> = POWer... | MODulation... | SPECtrum... etc., see</code> Table 5-1<code>)</code>
<code>CONFigure:RXQuality:BER<nr>|BAVerage:CONTrol <Mode>, 1 ... 50000 | NONE</code></td></tr>
<tr><td>Repetition mode
Single Shot</td><td>The measurement is stopped after one statistics cycle.</td><td><code>CONFigure:<meas_obj>:CONTrol:REPetition SINGleshot, <StopCondition>, <Stepmode> (<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum...)</code>
<code>CONFigure:RXQuality:BER<nr>:...</code></td></tr>
<tr><td>Continuous</td><td>The measurement is continued until stopped explicitly or by a limit failure. Average values are calculated according to the formulas in chapter 3, section "<i>General Settings</i>".</td><td><code>CONFigure:<meas_obj>:CONTrol:REPetition CONTinuous, <StopCondition>, <Stepmode> (<meas_obj> = WPOWer | POWer | MODulation | SPECtrum:MODulation, SPECtrum:SWITching)</code>
<code>CONFigure:RXQuality:BAVerage:...</code></td></tr>
<tr><td>Counting</td><td>Repeated single shot measurement with configured statistics cycles. The calculation of statistical quantities (minimum, maximum, average) is restarted after each statistics cycle; each cycle is treated as an independent single shot measurement.</td><td><code>CONFigure:<meas_obj>:CONTrol:REPetition 1 ... 10000, <StopCondition>, <Stepmode> (<meas_obj> = WPOWer | POWer... | MODulation... | SPECtrum...)</code>
This mode is not available for <code>RXQuality</code> measurements. A counting measurement with 1 evaluation period is equivalent to a single shot measurement..</td></tr>
<tr><td>Traces</td><td>The specifiers <code>CURRent, MAXimum, MINimum, MMAX,</code> and <code>AVERage</code> denote the traces for the current evaluation period, the maximum, minimum, extreme value, or average of a set of evaluation periods. They correspond to the <i>Display Mode</i> set in the measurement configuration menus.
In general all four traces are evaluated during the measurement. They are selected via a keyword in the queries initiating a measurement and retrieving the results.</td><td>Measurement results:
<code>READ:ARRay:<meas_obj>[:RESult]<disp>? ....</code>
where <code><meas_obj> = POWer... | MODulation...| SPECtrum...</code>
Burst matching:
<code>CALCULATE:<meas_obj>[:RESult]:LIMit:MATChing<disp>? ....</code>
where <code><disp> = [:CURRent] | :AVERage | :MMAXimum | :MAXimum | :MINimum</code></td></tr>
</table>

Specifying Limits

The following table gives an overview of the types of limits and possible results of the limit check.

Table 5-3 Limits and limit check

Type	**Description**	**Command**
Scalar limits	Limit values for a single (scalar) measured quantity. Depending on the measured quantity, either an upper limit or upper and lower limits can be defined.	`CONFigure:<meas_obj>:LIMit:<Spec.> [<LowerLimit>,]<UpperLimit>` `<Spec.>` denotes a keyword (an array of keywords) specifying the measured quantity.
Limit lines	For `POWer` and `SPECtrum` measurements a tolerance template consisting of up to 16 time ranges (areas) can be defined (the `POWer:MSLot` template is composed of several single-slot templates).	`CONFigure:<meas_obj>:LIMit:LINE:<Spec.> <Limit_line_param.>` `<Spec.>` denotes the two keywords specifying the upper or lower limit line in a time range and the burst type considered. `<Limit_line_param.>` contains the coordinates of the start and end points of the limit line plus an information whether the current range is valid or not.
Limit check	All scalar limits belonging to the same measurement group are read out together with the command on the right side.	`CALCulate:<meas_obj.>[:RESult]:LIMit: MATChing?`
	Possible results of the scalar limit check are listed on the right side. Further messages assessing, e.g., the power ramp or the result of the BER test in general, may be issued in particular cases (see detailed command description in chapter 6).	`NMAU` not matching, underflow `NMAL` not matching, overflow `INV` measured value invalid `OK` no limit failure

	The result of the limit check depends on the statistics settings (see section *Measurement Statistics* on page *5.5*).	`CALCULATE:ARRay:<meas_obj>[:RESult] :LIMit:MATChing<disp>?`
		`....`
		where `<disp> = [:CURRent] | :AVERage | | :MMAXimum | :MAXimum | :MINimum`

Status Reporting System

A general description of SCPI status registers and of the status reporting system is given in chapter 5 of the CMU operating manual. This section is devoted to the particular features concerning GSM measurements.

The CMU offers 30 independent `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers (<nr>=1 ... 15) which are implemented in hierarchical form. The bits of the 30 STATus:OPERation registers are set only after the registers are assigned to a function group and measurement mode.

In the CONDition part, the STATus:OPERation register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last readout. All fife parts of the registers can be read using one of the commands of the subsystem `STATus:OPERation:CMU:SUM1|2:CMU<nr>:...`

Note: *Symbolic status register evaluation by means of the commands `STATus:OPERation:SYMBolic:ENABle` and `STATus:OPERation:SYMBolic[:EVENt]?` is a convenient alternative method of retrieving status information. See also section* Symbolic Status Event Register Evaluation *in chapter 5 of the CMU operating manual and chapter 6 of this manual.*

GSM mobile tests comprise the two signalling modes *Non Signalling* and *Signalling* for each of the function groups *GSM400/850/900/1800/1900-MS* so that a total of 10 secondary addresses can be used. In the status registers for the *Non Signalling* mode no bits are assigned. In the status registers for the *Signalling* mode the bit assignment is as follows:

Table 5-5 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers assigned to *GSMxxx-MS Signalling*

Bit-No.	Meaning	Symbol in `STATus:OPERation:SYMBolic...`
0	**Call from Mobile** This bit is set while the CMU receives a call from the mobile under test.	**CFM**
1	**Release from Mobile** This bit is set while the connection to the mobile is being released.	**RFM**
2	**Synchronization Lost** This bit is set if the CMU had to leave the signalling state "Synchronized".	**SLOS**
3	**Location Update** This bit is set while a location update is being performed.	**LUPD**
7	**IMSI Detach** This bit is set if the CMU disconnected from the network.	**IDET**
8	**SMS received** This bit is set if a short message has been received but not yet read.	**SMSR**
10	**Measurement report** This bit is set if a measurement report from the mobile has been received.	**MREP**

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6 Remote Control – Commands

In the following, all remote-control commands for the function groups *GSM400/850/900/1800/1900-MS* will be presented in tabular form with their parameters and the ranges of values. The chapter is organized in analogy to the reference part for manual operation (chapter 4).

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, first general configurations and then the individual measurement groups (measurement objects) are described.

General notes on remote control in the function group *GSM400/850/900/1800/1900-MS* can be found in chapter 5. An introduction to remote control according to the IEEE 488.2/SCPI standard is given in chapter 5 of the CMU200/300 operating manual.

GSM Module Tests (Non Signalling)

In the *Non Signalling* mode, a GSM-specific RF signal can be generated and an RF signal with GSM characteristics analyzed. No signalling parameters are transferred.

Connection Control

The remote-control commands presented in this section determine the RF analyzer and trigger settings and the signals generated by the CMU, the inputs and outputs used as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control*, located to the right of the headline of each main menu.

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Input Level* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE *<Mode>*				Input level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	AUT	-	
Description of command				FW vers.
This command defines how the maximum input level is set.				2.10

[SENSe:]LEVel:MAXimum <*Level*> Max. Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–40 dBm to +53 dBm	Maximum input level for RF 1	+30.0	dBm	
–54 dBm to +39 dBm	Maximum input level for RF 2	+30.0		
–77 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0		

Description of command	FW vers.
This command defines the maximum expected input level. This is possible even if the level is determined automatically (command `LEV:MODE AUT`). The value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).	1.20

[SENSe:]LEVel:ATTenuation <*Mode*> Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal |	Mixer level in normal range	LNOise	–	
LNOise |	Low noise (mixer level 10 dB higher than in normal setting)			
LDIStortion	Low distortion (mixer level 10 dB lower than in normal setting)			

Description of command	FW vers.
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).	1.20

[SENSe:]LEVel:DEFault <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	The parameters differ from the default values (partially or totally)			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	1.20

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the table section *Trigger* in the *Analyzer* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*> Source

<Source>	Description of parameters	Def. value	Def. unit	Unit ring
FRUN	The power measurement is triggered by the TDMA timing.	FRUN	–	–
RFPower	Wideband power trigger.			
IFPower	Narrow-band trigger.			
EXTern	External trigger signal at socket AUX3.			

Description of command	FW vers.
This command determines the trigger condition. The settings *RFPower* and *IFPower* assume bursted signals.	1.15

TRIGger[:SEQuence]:THReshold <*Threshold*>				Level
<Threshold>	Parameter description	Def. value	Default unit	Unit ring
LOW | **MEDium |** **HIGH**	Low trigger threshold (reference level - 26 dB) Medium trigger threshold (reference level - 16 dB) High trigger threshold (Reference level - 6 dB)	LOW	–	
Command description				FW vers.
This command sets the signal level at which the measurement is triggered (see `TRIG:SEQ:SOUR`). The command is enabled for trigger source `RFPower` and `IFPower` only.				1.15

TRIGger[:SEQuence]:DEFault <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				1.15

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* configures the RF analyzer, i.e., it specifies which type of RF signals can be analyzed. It corresponds to the panel *Analyzer Settings* in the tab *Signal* in the popup menu *Connect. Control.*

[SENSe:]RFANalyzer:CHANnel <*Number*>				RF Channel
<Number>	Description of parameters	Def. value	Def. unit	Unit ring
0.2 MHz to 2700 MHz (see also data sheet)	Input frequency	455 (GSM400) 837 (GSM850) 903 (GSM900) 1750 (GSM1800) 1880 (GSM1900)	MHz MHz MHz MHz MHz	
Description of command				FW vers.
This command defines the frequency of the RF signal analyzed. As an alternative to frequencies, the corresponding GSM channels (with the character string CH annexed to the channel number) can be entered (259CH to 293 CH and 306 to 340 for GSM400, 128CH to 251CH for GSM850, 0CH to 124CH or 955CH to 1023CH for GSM900, 512CH to 885CH for GSM1800, 512CH to 810CH for GSM1900, see GSM channel tables in chapter 4). The assignment of channel numbers and frequencies meets the GSM specification for the uplink (signal direction from mobile to CMU). The query always returns frequencies.				2.0

[SENSe:]RFANalyzer:FREQuency:OFFSet *<FreqOffset>* Frequency Offset

<FreqOffset>	Description of parameters	Def. value	Def. unit	Unit ring
–100 kHz to +100 kHz	Offset for channel frequency	0	kHz	

Description of command	FW vers.
This command defines an offset for the channel frequency set with the command `[SENSe:]RFANalyzer:CHANnel <Number>`. The offset frequency must be in multiples of 1 Hz.	1.20

[SENSe:]RFANalyzer:TSEQuence *<TrainingSequence>* Training Sequence

<TrainingSequence>	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	No training sequence detected	OFF	–	
GSM0 to GSM7 |	GSM-specific training sequence			
DUMMy |	GSM dummy burst			
ANY	Arbitrary training sequence allowed			

Description of command	FW vers.
This command determines the training sequence of the signal analyzed. If no training sequence is specified *(OFF)*, the CMU measures all signals. In the setting *ANY*, it uses any training sequence for synchronization.	1.15

CONFigure:RFANalyzer:TPCL *<PCL>* TPCL

<PCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31	Template PCL	15	–	

Description of command	FW vers.
This command defines the template PCL which is used for dynamic limit line correction in the `POWer` measurement.	2.10

[SENSe:]RFANalyzer:MODulation *<Mod_Scheme>* Modulation

<Mod_Scheme>	Description of parameters	Def. value	Def. unit	Unit ring
GMSK | EPSK	Modulation scheme GMSK or EPSK	GMSK	–	

Description of command	FW vers.
This command selects one of the supported modulation schemes.	2.15

CONFigure:RFANalyzer:MCONtrol:TSOFfset *<Slots>* Trig. Slot Offset

<Slots>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Trigger slot offset, no. of slots	0	–	

Description of command	FW vers.
This command defines a delay time between the trigger time and the measured timeslot.	3.05

Generator Object "RFGenerator" – Generator control

The subsystem *RFGenerator* configures the RF signals generated by the CMU. It corresponds to the softkey *RF Generator* in the tab *Signal* in the popup menu *Connect. Control* and the measurement menu *Analyzer/Generator*.

INITiate:RFGenerator	Start RF generator, reserve resources	*RUN*
ABORt:RFGenerator	Switch off RF generator, release resources	*OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status indicated in the top right column.		1.15

FETCh:RFGenerator:STATus?				Generator
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **ERR**	Generator switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	
Description of command				FW vers.
This command is always a query. It returns the current generator status.				1.15

Generator Level – Subsystem RFGenerator:LEVel

The subsystem *RFGenerator:LEVel* determines the level of the generated RF signals. It corresponds to the input field *RF Level* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connect. Control.*

SOURce:RFGenerator:LEVel:UTIMeslot <Level>				RF Level used
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–27	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–27	dBm	
–90 dBm to +13 dBm	RF 3 OUT level in used timeslot	–27	dBm	
Description of command				FW vers.
This command determines the RF generator level in the used timeslot. The value range depends on the used RF output of the CMU and the external attenuation set (see `[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]` command). The level ranges and defaults are valid for GMSK-modulated generator signals. With 8PSK modulation, all level ranges are shifted by –4.0 dB and the default level for RF1 is changed to –31 dBm.				1.15

SOURce:RFGenerator:LEVel:UNTimeslot <*Level*>				RF Level unused
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–110 dB to +0 dB	Level in unused timeslots, RF 1	–80	dB	
–110 dB to +17 dB	Level in unused timeslots, RF 2	–80	dB	
–63 dB to +40 dB	Level in unused timeslots, RF 3 OUT	–80	dB	

Description of command	FW vers.
This command determines the RF generator level in the unused timeslots relative to the level in the used timeslot. The absolute level in the unused timeslots, i.e. the sum of numerical values set under *UTIMeslot* and *UNTimeslot* must also lie within the range for the RF output. This condition further restricts the permissible maximum level for the unused timeslots.	1.15

RF Generator Frequency – Subsystem RFGenerator:FREQuency

The subsystem *RFGenerator:FREQuency* determines the frequency of the generated RF signals. It corresponds to the softkeys *RF Channel* and *Freq. Offset* of the panel *RF Generator* in the tab *Signal* in the popup menu *Connect. Control.*

SOURce:RFGenerator:FM:DEViation <*FrequencyOffset*>				Frequency Offset
<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	Unit ring
–100 kHz to +100 kHz	Frequency offset	0	kHz	

Description of command	FW vers.
This command determines a frequency offset for the CMU signals in the selected RF channel (with respect to the frequency specified in the GSM standard).	1.15

SOURce:RFGenerator:FREQuency[:CHANnel] <*Number*>				RF Channel
<Number>	Description of parameters	Def. value	Def. unit	Unit ring
0.2 MHz to 2700 MHz (see also data sheet)	Input frequency	465 (GSM400) 882 (GSM850) 948 (GSM900) 1845 (GSM1800) 1960 (GSM1900)	MHz MHz MHz MHz MHz	

Description of command	**FW vers.**
This command defines the frequency of the RF signal generated. As an alternative to frequencies, the corresponding GSM channels (with the character string CH annexed to the channel number) can be entered ((259CH to 293 CH and 306 to 340 for GSM400, 128CH to 251CH for GSM850, 0CH to 124CH or 955CH to 1023CH for GSM900, 512CH to 885CH for GSM1800, 512CH to 810CH for GSM1900, see GSM channel tables in chapter 4). The assignment of channel numbers and frequencies meets the GSM specification for the downlink (signal direction from mobile to CMU). The query always returns frequencies.	

Subsystem RFGenerator:MODulation

The subsystem *RFGenerator:MODulation* determines an information which is modulated on the RF signal generated by the CMU and the signal shape. It corresponds to the panel *Generator Modulation* in the tab *Signal* in the popup menu *Connect. Control*.

CONFigure:RFGenerator:MODulation:BIT:SELection <*Selection*> Bit Modulation

<Selection>	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	No modulation sequence (unmod. carrier)	ALL0	–	
PRBS |	Pseudo-random bit sequence			
DUMMybursts |	GSM dummy bursts			
ALL0 |	Modulation sequence consisting of zeros			
EALL0 |	Zeros, 8PSK modulation			
EPRBs	Pseudo-random bit sequence, 8PSK mod.			

Description of command	FW vers.
The command selects a bit sequence used to modulate the generated signal.	1.15 2.15 (8PSK)

CONFigure:RFGenerator:MODulation:TSEQuence:SELection <*SELection*> Training Sequence

<Selection>	Description of parameters	Def. value	Def. unit	Unit ring
GSM0 to GSM7 |	GSM standard training sequences no. 0 to 7	GSM0	–	
DUMMy |	GSM dummy burst			
ALL0	Training sequence consisting of zeros only			

Description of command	FW vers.
The command selects a training sequence used to modulate the signal generated by the CMU.	1.15

CONFigure:RFGenerator:MODulation:TRANsmission <*Mode*> Transmission

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
BURSt |	Bursted RF signal	BURSt	–	
CONTinuous	Continuous signal			

Description of command	FW vers.
This command determines whether the CMU generates a burst or a continuous RF carrier signal.	1.15

Subsystem for Input and Output (External Attenuation at the Connectors)

The subsystem for input and output configures the input and output connectors. The subsystem corresponds to the tab *RF ⊕* in the popup menu *Connect. Control*.

INPut[:STATe] *<State>*				RF Input
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF4**	Connector RF 1 used as input Connector RF 2 used as input Connector RF 4 IN used as input	RF2	–	
Description of command				FW vers.
This command determines the connector to be used for RF input signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.				1.15

OUTPut[:STATe] *<State>*				RF Output
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF3**	Connector RF 1 used as output Connector RF 2 used as output Connector RF 3 OUT used as output	RF2	–	
Description of command				FW vers.
This command determines the connector to be used for RF output signals. The bidirectional connectors RF 1 and RF 2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`). Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.				1.15

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation>* **SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation>***				Ext. Att. Input
<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at input<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF4 IN (<nr> = 4)	0.0	dB	
Description of command				FW vers.
This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF4 IN)*.				1.15

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>* **SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>***				Ext. Att. Output
<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at output<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF3 OUT (<nr> = 3)	0.0	dB	
Description of command				FW vers.
This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF3 OUT)*.				1.15

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connect. Control.*

SOURce:DM:CLOCk:STATe *<Mode>* REF OUT 2 on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch on/off system clock	OFF	–	

Description of command	FW vers.
This commands switches the system clock specific to the network at the *REF OUT 2* connector on or off.	1.15

SOURce:DM:CLOCk:FREQuency <Frequency> REF OUT 2

<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
1.219 MHz to 39.000 MHz	Input value for the system clock	13.000	MHz	

Description of command	FW vers.
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values:	1.15

39.000 MHz,	19.500 MHz,	13.000 MHz,	9.750 MHz,	7.800 MHz,	6.500 MHz,	5.571 MHz,
4.875 MHz,	4.333 MHz,	3.900 MHz,	3.545 MHz,	3.250 MHz,	3.000 MHz,	2.786 MHz,
2.600 MHz,	2.438 MHz,	2.294 MHz,	2.166 MHz,	2.053 MHz,	1.950 MHz,	1.857 MHz,
1.773 MHz,	1.696 MHz,	1.625 MHz,	1.560 MHz,	1.500 MHz,	1.444 MHz,	1.393 MHz,
1.349 MHz,	1.300 MHz,	1.258 MHz,	1.219 MHz			

Measurement Groups (Non Signalling)

The measurement groups in this section are either provided in *Non Signalling* mode only or implemented with major differences in the two test modes.

POWer[:NORMal]

The subsystem *POWer[:NORMal]* measures the MS transmitter output power versus time. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

Important note on GMSK and 8PSK modulation:

> *The keywords `[:GMSK]` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands in Non Signalling measurements are included in firmware versions V2.15 and higher. The firmware version numbers quoted in the command tables refer to GMSK modulation.*

Control of measurement – Subsystem Power

The subsystem *POWer* controls the power measurement.

INITiate:POWer[:NORMal][:GMSK] **INITiate:POWer[:NORMal]:EPSK**	Start new measurement	RUN
ABORt:POWer[:NORMal][:GMSK] **ABORt:POWer[:NORMal]:EPSK**	Abort running measurement and switch off	OFF
STOP:POWer[:NORMal][:GMSK] **STOP:POWer[:NORMal]:EPSK**	Stop measurement after current stat. cycle	STOP
CONTinue:POWer[:NORMal][:GMSK] **CONTinue:POWer[:NORMal]:EPSK**	Next measurement step (only stepping mode)	RUN
Description of command		FW vers.
These commands have no query form. They start and stop the power measurement, setting it to the status indicated in the top right column.		1.15

CONFigure:POWer[:NORMal][:GMSK]:EREPorting <*Mode*> **CONFigure:POWer[:NORMal]:EPSK:EREPorting <*Mode*>**				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting*, see chapter 5 of CMU200 manual).				1.17

FETCh:POWer[:NORMal][:GMSK]:STATus?
FETCh:POWer[:NORMal]:EPSK:STATus?
Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	1.15

CONFigure:POWer[:NORMal][:GMSK]:TIME:BOFFset *<Offset>*
CONFigure:POWer[:NORMal]:EPSK:TIME:BOFFset *<Offset>*
Bit Offset

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 bit to +4.00 bit	Number of bits	0	bit	

Description of command	FW vers.
This command defines an offset time in ¼ bit units by which the burst is shifted relative to the time axis and the tolerance template.	2.15

CONFigure:POWer[:NORMal][:GMSK]:FILTer *<Filter>*
CONFigure:POWer[:NORMal]:EPSK:FILTer *<Filter>*
Filter

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500 for GMSK modulation B600 for 8PSK modulation	–	–

Description of command	FW vers.
This command selects the measurement filter for the *P/t* measurement. The default filter setting differs for the two modulation schemes.	V3.05

Test Configuration

The commands of the following subsystems determine the parameters of the signal power measurement. They correspond to the *Power Configuration* popup menu. For a detailed explanation of the different power tolerance templates defined in the GSM standard see chapter 4.

Subsystem POWer:CONTrol

The subsystem *POWer:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control tab* in the popup menu *Power Configuration.*

CONFigure:POWer[:NORMal][:GMSK]:CONTrol *<Mode>, <Statistics>* Scope of Measurement
CONFigure:POWer[:NORMal]:EPSK:CONTrol *<Mode>, <Statistics>*

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	
ARRay	Scalar measured values and arrays			

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	
NONE	Statistics off (equivalent to 1)			

Description of command	FW-Vers.
This command specifies the type of measured values and defines the number of bursts forming a statistics cycle.	1.15

CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition
CONFigure:POWer[:NORMal]:EPSK:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode> Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE,	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	1.15

DISPlay:POWer[:NORMal][:GMSK]:CONTrol:GRID *<Enable>* Grid
DISPlay:POWer[:NORMal]:EPSK:CONTrol:GRID *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on the grid lines	ON	–	
OFF	Switch off the grid lines			

Description of command	FW vers.
This command switches the grid lines in the test diagram on or off.	1.15

CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode *<Mode>* Ref. Power Mode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CURRent |	Ref. Power calculated from current burst	CURR	–	
AVERage |	Ref. Power calculated from average curve			
DCOMpens	Data compensated/corrected reference power			

Description of command	FW vers.
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.	2.15

CONFigure:POWer[:NORMal][:GMSK]:CONTrol:DEFault <Enable>
CONFigure:POWer[:NORMal]:EPSK:CONTrol:DEFault <Enable>
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	2.0

Subsystem POWer:LIMit:LINE

The subsystem *POWer:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>[:STATic]:ENABle ***<Enable>***
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic]:ENABle ***<Enable>***
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>[:STATic]
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic]
Upper Limit Line

Parameters for query: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <StartVisibility>, <EndVisibility>***

for setting: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>***

Parameters	Value range	Description of parameters	Def. values
<Enable>	ON | OFF	Area on/off	see below
<StartTime>,	–10 bit to +156 ¾ bit | OFF	Start point of time	
<EndTime>,	–10 bit to +156 ¾ bit | OFF,	End point of time	
<StartRelLevel>,	–100 dB to 20 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 20 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 50.0 dBm OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 50.0 dBm | OFF,	End point of level (absolute)	
<Visibility> **<StartVisib>** **<EndVisib>**	ON | OFF	Range of limit lines on/off	

Description of command	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	1.15

For GMSK modulation (keyword `[:GMSK]`), 8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings are given in the table below:

	for Enable		forTable					
Suffix	Enable	Start Time	Stop Time	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.0 bit	–7 ¼ bit	–59.0[1] dB	–59.02 dB	–36.0[2] dBm	–36.0[2] dBm	ON
2	ON	–7 ¼ bit	–4 ½ bit	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
3	ON	–4 ½ bit	–2 ¼ bit	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2 ¼ bit	+½ bit	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	½ bit	150 ¼ bit	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150 ¼ bit	152 ½ bit	–6.0 dB	–6.0 dB	OFF	OFF	ON
7	ON	152 ½ bit	155 ¼ bit	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
8	ON	155 ¼ bit	156 ¾ bit	–59.0[1] dB	–59.0[1] dB	–36.0[2] dBm	–36.0[2] dBm	ON
9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The setting *Visibility* = *Off* implies that the corresponding range, including the limit check, is switched off. *Enable* = *Off* switches off the entire limit check.

The default settings for 8MSK modulation (EDGE channels, keyword `:EPSK`) are given in the table below:

	for Enable		forTable					
Suffix	Enable	Start Time	Stop Time	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.0 symb	–7 ¼ symb	–59.0[1] dB	–59.0[1] dB	–36.0[2] dBm	–36.0[2] dBm	ON
2	ON	–7 ¼ symb	–4 ½ symb	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
3	ON	–4 ½ symb	–2 ¼ symb	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2 ¼ symb	+½ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	½ symb	1 ½ symb	+2.4 dB	+2.4 dB	OFF	OFF	ON
6	ON	1 ½ symb	146 ½ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
7	ON	146 ½ symb	147 ½ symb	+2.4 dB	+2.4 dB	OFF	OFF	ON
8	ON	147 ½ symb	150 ¼ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
9	ON	150 ¼ symb	152 ½ symb	–6.0 dB	–6.0 dB	OFF	OFF	ON
10	ON	152 ½ symb	155 ¼ symb	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
11	ON	155 ¼ symb	156 ¾ symb	–59.0[1] dB	–59.0[1] dB	–36.0[2] dBm	–36.0[2] dBm	ON
12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

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[1] GSM400/850/900. The value for GSM1800 and GSM1900 is –48.0 dB.

[2] GSM400/850/900. The value for GSM1800 and GSM1900 is –48.0 dBm.

[3] GSM400/850/900. The value for GSM1800 and GSM1900 is –20.0 dBm.

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>[:STATic]:ENABle *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]:ENABle *<Enable>*

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>[:STATic]
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic] Lower Limit Line

Parameters for query:	*<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <StartVisibility>, <EndVisibility>*
for setting:	*<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>*

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit to +156 ¾ bit | OFF	Start point of time	
<EndTime>,	–10 bit to +156 ¾ bit | OFF,	End point of time	
<StartRelLevel>,	–100 dB to 20 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 20 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 50 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 50 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	
<StartVisib.>			
<EndVisib>			

Description of command	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the various areas in the burst diagram (see chapter 4).	1.15

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings for GMSK modulation (keyword `[:GMSK]`) are shown in the table below:

	for Enable		for Table					
	Start	Stop	Start	Stop	Start	Stop		
Suffix	Enable	Time	Time	rel.Level	rel.Level	abs.Level	abs.Level	Visibility
1	ON	–10.0 bit	½ bit	OFF	OFF	OFF	OFF	OFF
2	ON	½ bit	147 ½ bit	–1.0 dB	–1.0 dB	OFF	OFF	ON
3	ON	147 ½ bit	156 ¾ bit	OFF	OFF	OFF	OFF	ON
4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The default settings for 8MSK modulation (EDGE channels, keyword `:EPSK`) are given in the table below:

	for Enable		for Table					
	Start	Stop	Start	Stop	Start	Stop		
Suffix	Enable	Time	Time	rel.Level	rel.Level	abs.Level	abs.Level	Visibility
1	ON	–10.0 symb	½ symb	OFF	OFF	OFF	OFF	OFF
2	ON	½ symb	1 symb	–2.0 dB	–2.0 dB	OFF	OFF	ON
3	ON	1 symb	1 ½ symb	0.0 dB	0.0 dB	OFF	OFF	ON
4	ON	1 ½ symb	146 ½ symb	–15.0 dB	–15.0 dB	OFF	OFF	ON
5	ON	146 ½ symb	147 symb	0.0 dB	0.0 dB	OFF	OFF	ON
6	ON	147 symb	147 ½ symb	–2.0 dB	–2.0 dB	OFF	OFF	ON
7	ON	147 ½ symb	156 ¾ symb	OFF	OFF	OFF	OFF	OFF
8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>:ENABle
<Enable>

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>
<fromTPCL>, <toTPCL>, <Correction>, <Enable> Dynamic Correction

<fromTPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | OFF	First template PCL for which area <AreaNr> is changed	See table below	–	

<toTPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | OFF	Last template PCL for which area <AreaNr> is changed.	See table below	–	

<Correction>	Description of parameters	Def. value	Def. unit	Unit ring
-10 dB to +10 dB | OFF	Correction value (relative) for the limit line in area <AreaNr> applied for all template PCLs between <fromTPCL> and <toTPCL>	See table below	dB	

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable dynamic correction in the current limit line area and PCL range	See table below	–	

Description of command	FW vers.
These command activates and defines dynamic correction of the upper limit line of area <AreaNr> (<AreaNr> = 1 to 16) depending on the template PCL range <RangeNr> (<RangeNr> = 1 to 10 for each area). The template PCL is set via `CONFigure:RFANalyzer:TPCL`.	2.0

In the areas no. 3 and 6, the following ranges are defined (both modulation schemes):

Range	**fromTPCL**	**toTPCL**	**Correction**	**Enable**
1	16	16	+2.0 dB	ON
2	17	17	+4.0 dB	ON
3	18	19	+5.0 dB	ON
4	OFF	OFF	0.0 dB	OFF
5	OFF	OFF	0.0 dB	OFF
6	OFF	OFF	0.0 dB	OFF
7	OFF	OFF	0.0 dB	OFF
8	OFF	OFF	0.0 dB	OFF
9	OFF	OFF	0.0 dB	OFF
10	OFF	OFF	0.0 dB	OFF

In the remaining areas, the dynamic limit line correction is disabled in all ranges.

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:ALL:DYNamic:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:ALL:DYNamic:ENABle
<Enable> Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction on or off	ON	–	

Description of command	FW vers.
This command switches the dynamic correction of the upper limit area <nr> for all ten TPCL ranges on or off.	2.0

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer:ALL:DYNamic:ENABle *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer:ALL:DYNamic:ENABle *<Enable>*

Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction for the whole template on or off	ON	–	

Description of command	FW vers.
This command switches the dynamic correction of the upper limit line in all areas and for all TPCL ranges on or off. The query returns 160 Boolean values corresponding to the limit check in PCL ranges 1 to 10 (inner loop) in each of the areas 1 to 16 (outer loop).	2.0

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<AreaNr>:DYNamic<RangeNr>
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:DYNamic<RangeNr>
<fromTPCL>, <toTPCL>, <Correction>, <Enable>

Dynamic Correction

<fromTPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | OFF	First TPCL for which area <AreaNr> is changed	OFF	TPCL	
<toTPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | OFF	Last TPCL for which area <AreaNr> is changed.	OFF	TPCL	
<Correction>	Description of parameters	Def. value	Def. unit	Unit ring
-10 dB to +10 dB | OFF	Correction value (relative) for the limit line in area <AreaNr> applied for all TPCLs between <fromTPCL> and <toTPCL>	OFF	dB	
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable dynamic correction in the current limit line area and TPCL range	OFF	–	

Description of command	FW vers.
These command activates and defines dynamic correction of the lower limit line of <AreaNr> (<AreaNr> = 1 to 16) depending on the template PCL range <RangeNr> (<RangeNr> = 1 to 10 for each area). The template PCL is set via `CONFigure:RFANalyzer:TPCL`. By default, the dynamic limit line correction is disabled in all ranges and areas.	2.0

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle
<Enable>

Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction on or off	OFF	–	

Description of command	FW vers.
This command switches the dynamic correction of the lower limit area <AreaNr> for all ten template PCL ranges on or off. The query returns 160 Boolean values corresponding to the limit check in PCL ranges 1 to 10 (inner loop) in each of the areas 1 to 16 (outer loop).	2.0

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer:ALL:DYNamic:ENABle *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer:ALL:DYNamic:ENABle *<Enable>*

Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction for the whole template on or off	OFF	–	

Description of command	FW vers.
This command switches the dynamic correction of the lower limit line in all areas and for all template PCL ranges on or off.	2.0

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:DEFault *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:DEFault *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	1.15

Subsystem POWer:LIMIt:ABPower

The subsystem *POWer:LIMit:ABPower* defines the limit values for the average burst power. The subsystem corresponds to the tab *Limits* in the popup menu *Power Configuration.*

CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>
<StartPCL>, <StopPCL>, <LowerLimit>, <UpperLimit>
CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>:ENABle *<Enable>*

Average Burst Power

Parameter	Value range	Description of parameters	Def. value
<Enable>	**ON | OFF**	Definition section on/off	see below
<StartPCL>,	**0 to 31**	Start value for PCL	see below
<StopPCL>,	**0 to 31**	End value for PCL	
<LowerLimit>,	**–10.0 dB to 0.0 dB**	Lower level limit	
<UpperLimit>	**0.0 dB to +10.0 dB**	Upper level limit	

Description of command	FW vers.
These commands determine the tolerances for ranges of template power control levels (TPCLs). <nr> is the number of the group ($<nr> \in \{1,...,10\}$) The setting *MAX* is synonymous with the highest TPCL.	≥1.15

4 level ranges are defined in the default setting, another 6 ranges can be activated if required. The default settings for GSM 900/1800/1900 will be given in the following table:

	For Enable	for table			
Suffix	Enable	StartPCL	StopPCL	LowerLimit	UpperLimit
1	ON	MAX	MAX	–2.0 dB	+2.0 dB
2	ON	0	2/8/8	–2.0/–3/–3 dB	+2.0/3.0/3.0 dB
3	ON	3/9/9	15/13/13	–3.0/–4/–4 dB	+3.0/4.0/4.0 dB
4	ON	16/14/14	31/28/29	–5.0 dB	+5.0 dB
5	OFF/ON/ON	OFF/29/30	OFF/29/31	OFF/–2.0/–2.0 dB	OFF/5.0/2.0 dB
6	OFF/ON/OFF	OFF/30/OFF	OFF/31/OFF	OFF/–3.0 dB/OFF	OFF/2.0 dB/OFF
10	OFF	OFF	OFF	OFF	OFF

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer[:NORMal][:GMSK] Definition of Subarrays
CONFigure:SUBarrays:POWer[:NORMal]:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
–10 bit to 156 ¾ bit,	Start time in current range (in bit for GMSK, symbols for 8PSK modulation)	–10	bit	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 668	Number of samples in current range	668	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	2.0

Measured Values – Subsystem POWer

The subsystem *POWer* determines and returns the results of the signal power measurement. They correspond to the graphical measurement menu *Power* with its various display elements.

READ[:SCALar]:POWer[:NORMal][:GMSK]? Scalar results:
READ[:SCALar]:POWer[:NORMal]:EPSK?
Start single shot measurement and return results

FETCh[:SCALar]:POWer[:NORMal][:GMSK]?
FETCh[:SCALar]:POWer[:NORMal]:EPSK?
Read out measurement results (unsynchronized)

SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?
SAMPle[:SCALar]:POWer[:NORMal]:EPSK?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
AvgBurstPwAvg	–137 dBm to +53 dBm	NAN	dBm	

Description of command

FW vers. 1.15

These commands are always queries. They start a measurement and return all scalar measurement results (see chapter 5). These are:

Average power of current burst
Peak power of current burst
Burst out of tolerance
Average power of averaged trace

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *display modes*).The following messages may be returned for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

CALCulate[:SCALar]:POWer[:NORMal][:GMSK]:LIMit:MATChing?
CALCulate[:SCALar]:POWer[:NORMal]:EPSK:LIMit:MATChing?

Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	MATC | NMAT | INV | NTSC | OUT	INV	–	
AvgBurstPwAvg	NMAU | NMAL | INV | OK	INV	–	

Description of command

FW vers. 1.15

This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded.

The following messages may be returned for the values *AvgBurstPower and PeakBurstPower*:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

The following messages may be returned for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
NTSC	*no training sequence code*
OUT	*out of range*

READ:ARRay:POWer[:NORMal][:GMSK][:CURRent]? Burst Power

READ:ARRay:POWer[:NORMal]:EPSK[:CURRent]?

READ:ARRay:POWer[:NORMal][:GMSK]:AVERage?

READ:ARRay:POWer[:NORMal]:EPSK:AVERage?

READ:ARRay:POWer[:NORMal][:GMSK]:MAXimum?

READ:ARRay:POWer[:NORMal]:EPSK:MAXimum?

READ:ARRay:POWer[:NORMal][:GMSK]:MINimum?

READ:ARRay:POWer[:NORMal]:EPSK:MINimum?

Start single shot measurement and return results RUN

FETCh:ARRay:POWer[:NORMal][:GMSK][:CURRent]?

FETCh:ARRay:POWer[:NORMal]:EPSK[:CURRent]?

FETCh:ARRay:POWer[:NORMal][:GMSK]:AVERage?

FETCh:ARRay:POWer[:NORMal]:EPSK:AVERage?

FETCh:ARRay:POWer[:NORMal][:GMSK]:MAXimum?

FETCh:ARRay:POWer[:NORMal]:EPSK:MAXimum?

FETCh:ARRay:POWer[:NORMal][:GMSK]:MINimum?

FETCh:ARRay:POWer[:NORMal]:EPSK:MINimum?

Read meas. results (unsynchronized) RUN

SAMPle:ARRay:POWer[:NORMal][:GMSK][:CURRent]?

SAMPle:ARRay:POWer[:NORMal]:EPSK[:CURRent]?

SAMPle:ARRay:POWer[:NORMal][:GMSK]:AVERage?

SAMPle:ARRay:POWer[:NORMal]:EPSK:AVERage?

SAMPle:ARRay:POWer[:NORMal][:GMSK]:MAXimum?

SAMPle:ARRay:POWer[:NORMal]:EPSK:MAXimum?

SAMPle:ARRay:POWer[:NORMal][:GMSK]:MINimum?

SAMPle:ARRay:POWer[:NORMal]:EPSK:MINimum?

Read results (synchronized) RUN

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB,	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼ bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to 156 ¾ bit. The calculation of results in the modes *current, average, maximum* and *minimum* is explained in chapter 3 (cf. *display modes*).	1.15

READ:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]? Subarray Results
READ:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
READ:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
READ:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
READ:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
READ:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?
FETCh:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Read results (synchronized) ⇒ *RUN*

Ret. values by subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command

FW vers.

2.0

These commands are always queries. They output the burst power versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned by subrange.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).

CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MINimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MINimum?

Burst Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
<Matching>	MATC | NMAT | INV | NTSC | OUT	INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the burst power (see preceding command) have been exceeded. The following messages may be returned for the measured value *Matching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of tolerance*	1.15

CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MINimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MINimum?

Range Violation

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
32 bit value,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit value	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	–

Description of command	FW vers.
This command is always a query. If a bit is set in the two returned values the corresponding section of the limit lines is exceeded.	1.20

POWer:MPR

The subsystem *POWer:MPR* combines the *POWer* and *MODulation* systems, i.e. it measures the signal power vs. time and the scalar modulation parameters simultaneously. The subsystem contains all commands for measurement control and for the output of measurement results; configurations such as limit lines must be defined separately in the *POWer* and *MODulation* systems.

The *POWER:MPR* has no equivalent in manual control where the power and modulation measurement results are displayed separately.

Control of measurement – Subsystem POWer:MPR

The subsystem *POWer:MPR* controls the combined power and modulation measurement.

INITiate:POWer[:NORMal][:GMSK]:MPR	Start new measurement	*RUN*
ABORt:POWer[:NORMal][:GMSK]:MPR	Abort running measurement and switch off	*OFF*
STOP:POWer[:NORMal][:GMSK]:MPR	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer[:NORMal][:GMSK]:MPR	Next meas. step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the combined power and modulation measurement, setting it to the status indicated in the top right column.	2.0

CONFigure:POWer[:NORMal][:GMSK]:MPR:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU200 manual).	2.0

FETCh:POWer[:NORMal][:GMSK]:MPR:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5).	2.0

Subsystem POWer:MPR:CONTrol

The subsystem *POWer:MPR:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement.

CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol *<Mode>, <Statistics>*

Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
Description of command				FW-Vers.
This command specifies the type of measured values and defines the number of bursts forming a statistics cycle.				2.0

CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				2.0

Test Configuration

The commands of the following subsystems configure the combined power and modulation measurement. Note that configurations such as limit lines must be defined separately in the *POWer* and *MODulation* systems.

Subsystem SUBarrays:POWer:MPR

The subsystem *SUBarrays:POWer:MPR* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum |	Return maximum value in every range			
IVAL,	Return single interpolated value at <Start>			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–10 bit to 156 ¾ bit,	Start time in current range	–10	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 668	Number of samples in current range	668	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...,`, and `SAMPle:SUBarrays:POWer:MPR` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *Power* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	2.0

Measured Values – Subsystem POWer:MPR

The subsystem *POWer:MPR* determines and returns the results of the combined power and modulation measurement.

READ[:SCALar]:POWer[:NORMal][:GMSK]:MPR? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:POWer[:NORMal][:GMSK]:MPR?
Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]:MPR?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
BurstMatching,	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPwAvg	–137 dBm to +53 dBm	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a combined power vs. time and modulation measurement and return all scalar measurement results. For detailed information refer to the description of the analogous commands in the POWer and MODulation systems.	2.0

READ:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]? Traces
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of comm	FW vers.
These commands are always queries. They return the burst power versus time in a fixed ¼- bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to 156 ¾ bit. The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.0

READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]? Subarray Results
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?
Start measurement and wait for end ⇒ *RUN*
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read results (synchronized) ⇒ *RUN*

Ret. values by subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned by subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.0

CALCulate[:SCALar]POWer[:NORMal][:GMSK]:MPR:LIMit:MATChing? Tolerance Error

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
PhErrPeakCurrent,	For all measured values: NMAU | NMAL | INV | OK	INV	–	
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,		INV	–	
PhErrRMSCurrent,		INV	–	
PhErrRMSAverage,		INV	–	
PhErrRMSMaxMin,		INV	–	
FreqErrCurrent,		INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin,		INV	–	
AvgBurstPwAvg		INV	–	

Description of command

FW vers. 2.0

This command is always a query. It indicates whether and in which way the tolerances for the scalar results (see command above) in the *Power* and the *modulation* measurement have been exceeded.

The following messages may be returned for the values *AvgBurstPower* and *PeakBurstPower* and for all results of the modulation measurement:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

The following messages may be returned for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

Common Measurement Groups

The commands for the measurement groups in this section are identical or almost identical in both test modes. Minor differences between *Non Signalling* and *Signalling* commands are possible; they will be pointed out throughout the section.

Note1: Measurements and signalling states

To perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, if the measurements reported in this section are performed in Signalling mode, the Call Established (CEST) signalling state must be reached before any of the commands retrieving test results (`READ...?`, `FETCh...?`, `SAMPle...?`, or `CALCulate...LIMit?`) can be used. Test configurations, however, can be defined any time.

Exception: *The wideband power (`WPOWer`) does not involve any signalling. It can be measured irrespective of the current signalling state.*

Note2: GMSK and 8PSK modulation

The keywords `[:GMSK]` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands in Signalling measurements are included in firmware versions V3.05 and higher. The firmware version numbers quoted in the command tables refer either to GMSK modulation or EPSK modulation in Non Signalling mode.

WPOWer

The subsystem *WPOWer* measures the power of the signal transmitted by the mobile phone using a wideband filter. It corresponds to the softkey *Wideband Power* in the *Connect. Control* menu.

INITiate:WPOWer	Start new measure ment	*RUN*
ABORt:WPOWer	Abort measurement and switch off	*OFF*
STOP:WPOWer	Stop measurement	*STOP*
CONTinue:WPOWer	Next measurement step (only *counting mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.		1.15[1]

CONFigure:WPOWer:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 operating manual).				1.17

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[1] For firmware versions <V2.15, the keyword `WPOWer` is replaced by `SPOWer` in all commands.

FETCh:WPOWer:STATus?				Measurement
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 ... 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual of CMU200 operating manual).				1.15

CONFigure:WPOWer:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*				Test cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				1.15

Measured Values – Subsystem WPOWer?

The subsystem *WPOWer?* retrieves the results of the wideband power measurement.

READ[:SCALar]:WPOWer? **FETCh[:SCALar]:WPOWer?** **SAMPle[:SCALar]:WPOWer?**		Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)		
Return	Description of parameters	Def. value	Def. unit	Unit ring
–30.0dBm to +30.0 dBm	Maximum burst power (not averaged)	NAN	dBm	
Description of command				FW vers.
These commands are always queries. They start the measurement of the maximum burst power *(peak burst power)* and return the result.				1.15

NPOWer

The subsystem *NPOWer* measures the power of the signal transmitted by the mobile phone using the RF analyzer configuration of the *POWer* measurement. Compared to *WPOWer*, the *NPOWer* measurement uses a narrow-band (500 kHz Gauss) filter.

The narrow-band *NPOWer* measurement yields the average, maximum and minimum burst power of the current burst (display mode *Current)* and of the averaged measurement curve (display mode *Average)*. The entire measurement curves (arrays) are not available, and no limit check is performed. *NPOWer* is a quick and precise alternative to the *WPOWer* or *POWer* measurements if only scalar results are needed.

Note: *A* Free Run *trigger (`TRIGger[:SEQuence]:SOURce FRUN`) should be avoided because it delays the `NPOWer` measurement.*

INITiate:NPOWer	Start new measure ment	*RUN*
ABORt:NPOWer	Abort measurement and switch off	*OFF*
STOP:NPOWer	Stop measurement	*STOP*
CONTinue:NPOWer	Next measurement step (only *counting mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.		V3.05

CONFigure:NPOWer:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 operating manual).				V3.05

FETCh:NPOWer:STATus?				Measurement
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual of CMU200 operating manual).				V3.05

Subsystem NPOWer:CONTrol

The subsystem *NPOWer:CONTrol* defines the repetition mode, statistic count, stop condition, and stepping mode of the *NPOWer* measurement.

CONFigure:NPOWer:CONTrol *<Statistics>*, *<Repetition>*,*<StopCond>*,*<Stepmode>*Scope of Measurement

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V3.05

CONFigure:NPOWer:CONTrol:STATistics *<Statistics>* Scope of Measurement

<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V3.05

CONFigure:NPOWer:CONTrol:REPetition ***<Repetition>,<StopCond>,<Stepmode>***				Test cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V3.05

Measured Values – Subsystem NPOWer?

The subsystem *NPOWer?* retrieves the results of the narrow-band power measurement.

READ[:SCALar]:NPOWer? **FETCh[:SCALar]:NPOWer?** **SAMPle[:SCALar]:NPOWer?**	Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	Unit ring
Avg. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Avg. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Average Burst	–137 dBm to +53 dBm	NAN	dBm	
Description of command				FW vers.
These commands are always queries. They start the *NPOWer* measurement and return the results.				V3.05

POWer:SLOT

The subsystem *POWer:SLOT* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power* with the applications *P/Slot Graph.*

Note: *The* `POWer:SLOT` *measurement can not be carried out with a* Free Run *trigger (*`TRIGger[:SEQuence]:SOURce FRUN`*).*

INITiate:POWer:SLOT	Start new measurement	*RUN*
ABORt:POWer:SLOT	Abort running measurement and switch off	*OFF*
STOP:POWer:SLOT	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:SLOT	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V2.15

CONFigure:POWer:SLOT:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V2.15

FETCh[:SCALar]:POWer:SLOT:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

POWer:SLOT:CONTrol

CONFigure:POWer:SLOT:CONTrol:REPetition *<Repetition>,<StopCondition>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot,* `until Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.15

CONFigure:POWer:SLOT:CONTrol:DEFault <Enable>

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	–
OFF	The parameters differ from the default values (partially or totally)			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.15

Subsystem SUBarrays:POWer:SLOT

The subsystem *SUBarrays:POWer:SLOT* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:SLOT <Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum |	Return maximum value in every range			
IVAL,	Return single interpolated value at <Start>			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7,	Start time in current range	0	–	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 8	Number of samples in current range	8	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...,`, and `SAMPle:SUBarrays:POWer:SLOT` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the current number of the first slot and the number of slots within a subrange. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *P/Slot Graph* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.15

Subsystem POWer:SLOT

The subsystem *POWer:SLOT* contains the commands for measurement and output of the power versus slot application. The subsystem corresponds to the measurement menu *P/SLOT Graph.*

READ[:SCALar]:POWer:SLOT:SPOWer<nr>? Single Result

Start single shot measurement and return results

FETCh[:SCALar]:POWer:SLOT:SPOWer<nr>?

Read out measurement results (unsynchronized)

SAMPle[:SCALar]:POWer:SLOT:SPOWer<nr>?

Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm	Avg. power in slot <nr>	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return the average power in a particular timeslot (numbered by <nr>=1 to 8, corresponding to timeslots 0 to 7).	V2.15

P/Slot Graph Results

READ:ARRay:POWer:SLOT? Start single shot measurement and return results
FETCh:ARRay:POWer:SLOT? Read out measurement results (unsynchronized)
SAMPle:ARRay:POWer:SLOT? Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in slot 0,	NAN,	dBm,	
...	...,	...,	...,	
–100 dBm to 100 dBm	Avg. power in slot Slot 7	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the mobile phone in eight consecutive timeslots.	V2.15

Subarray Results

READ:SUBarrays:POWer:SLOT? Start single shot measurement and return results
FETCh:SUBarrays:POWer:SLOT? Read out measurement results (unsynchronized)
SAMPle:SUBarrays:POWer:SLOT? Read out measurement results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in first slot,	NAN	dB	
...	...,	...	...	
–100 dBm to 100 dBm	Avg. power in last slot	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.15

POWer:XSLot

The subsystem *POWer:XSLot* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power* with the applications *P/Slot Table*.

Note: *The `POWer:XSLot` measurement can not be carried out with a* Free Run *trigger (`TRIGger[:SEQuence]:SOURce FRUN`).*

INITiate:POWer:XSLot	Start new measurement	*RUN*
ABORt:POWer:XSLot	Abort running measurement and switch off	*OFF*
STOP:POWer:XSLot	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:XSLot	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V2.15

CONFigure:POWer:XSLot:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V2.15

FETCh[:SCALar]:POWer:XSLot:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

Subsystem POWer:XSLot:CONTrol

CONFigure:POWer:XSLot:CONTrol:REPetition *<Repetition>,<StopCondition>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot*, `until Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.15

CONFigure:POWer:XSLot:CONTrol:DEFault <Enable>

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	–
OFF	The parameters differ from the default values (partially or totally)			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.15

Subsystem POWer:XSLot:SCOunt

The subsystem *POWer:XSLot:SOUnt* defines the total number of slots measured. It corresponds to the *Slot Count* parameter in the *Control* tab of the *Power Configuration* menu.

CONFigure:POWer:XSLot:SCOunt *<Group>[,<Number>]* Slot Count

<Group>	Description of parameters	Def. value	Def. unit	Unit ring
S128 | S256 | S384 | S512	Number of slots measured, if an integer multiple of 128	S128	–	–

<Number>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 512	Number of slots measured, for FW vers. V3.05 and higher	128	–	–

Description of command

This command defines the total number of slots measured. The first parameter sets the slot count in multiples of 128 (Sn where n = 1 to 4) and defines the number of returned values. The second parameter is equal to the *Slot Count* in manual control and must be used if a *Slot Count* m ≠ n*128 is desired. m supersedes n such that n ≥ m.

FW vers.
V2.15

Examples:

- `CONF:POW:XSL:SCO S128,128` causes 128 values to be calculated and returned.
- `CONF:POW:XSL:SCO S128,129` is equivalent to `CONF:POW:XSL:SCO S256,129`. 129 values are measured. The output arrays of the `XSLot` measurement group consist of 129 valid and 127 invalid (NAN) results.

Subsystem SUBarrays:POWer:XSLot

The subsystem *SUBarrays:POWer:XSLot* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:XSLot <Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 511,	Start time in current range	0	–	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 512	Number of samples in current range	512	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...,`, and `SAMPle:SUBarrays:POWer:XSLot` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the current number of the first slot and the number of slots within a subrange. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *P/Slot Table* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.15

Subsystem POWer:XSLot

The subsystem *POWer:XSLot* contains the commands for measurement and output of the power versus slot application. The subsystem corresponds to the measurement menu *P/Slot Table.*

Single Result

READ[:SCALar]:POWer:XSLot:SPOWer<nr>?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:XSLot:SPOWer<nr>?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:XSLot:SPOWer<nr>?	Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm	Avg. power in slot <nr>	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return the average power in a particular timeslot (numbered by <nr>=1 to 128, corresponding to slot 0 to slot 127 of the graphical user interface). The number of slots measured can be incrased by means of the `CONFigure:POWer:XSLot:SCOunt` command.	V2.15

P/Slot Graph Results

READ:ARRay:POWer:XSLot?	Start single shot measurement and return results
FETCh:ARRay:POWer:XSLot?	Read out measurement results (unsynchronized)
SAMPle:ARRay:POWer:XSLot?	Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in slot 0,	NAN,	dBm,	
...	...,	...,	...,	
–100 dBm to 100 dBm	Avg. power in slot Slot 127	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the mobile phone in 128 consecutive timeslots.	V2.15

Subarray Results

READ:SUBarrays:POWer:XSLot?	Start single shot measurement and return results
FETCh:SUBarrays:POWer:XSLot?	Read out measurement results (unsynchronized)
SAMPle:SUBarrays:POWer:XSLot?	Read out measurement results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in first slot,	NAN	dB	
...	...,	...	...	
–100 dBm to 100 dBm	Avg. power in last slot	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.15

POWer:FRAMe

The subsystem *POWer:FRAMe* controls the *Power vs. Frame* measurement. It corresponds to the measurement menu *Power* with the applications *P/Frame*.

Note: *The* `POWer:FRAMe` *measurement can not be carried out with a* Free Run *trigger (*`TRIGger[:SEQuence]:SOURce FRUN`*).*

INITiate:POWer:FRAMe	Start new measurement	*RUN*
ABORt:POWer:FRAMe	Abort running measurement and switch off	*OFF*
STOP:POWer:FRAMe	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:FRAMe	Next measurement step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V2.15

CONFigure:POWer:FRAMe:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).	V2.15

FETCh[:SCALar]:POWer:FRAMe:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	V2.15

CONFigure:POWer:FRAMe:FCOunt <*No_of_Frames*> Frame Count

<No_of_Frames>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 128	Number of measured frames	128	–	–

Description of command	FW vers.
This command defines the number of consecutive frames measured.	V3.05

Subsystem POWer:FRAMe:CONTrol

CONFigure:POWer:FRAMe:CONTrol:REPetition *<Repetition>,<StopCondition>,<Stepmode>*				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot,* `until Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW vers.
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.15

CONFigure:POWer:FRAMe:CONTrol:DEFault <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	–
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.15

Subsystem SUBarrays:POWer:FRAMe

The subsystem *SUBarrays:POWer:FRAMe* defines the measurement range and the type of return values.

CONFigure:SUBarrays:POWer:FRAMe <Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 127,	Start time in current range	0	–	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 128	Number of samples in current range	128	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...,`, and `SAMPle:SUBarrays:POWer:FRAMe` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the current number of the first slot and the number of slots within a subrange. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *P/Frame* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.15

Subsystem POWer:FRAMe

The subsystem *POWer:FRAMe* contains the commands for measurement and return of the power versus slot application. The subsystem corresponds to the measurement menu *P/Slot Table.*

Single Result

READ[:SCALar]:POWer:FRAMe:FPOWer<nr>?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:FRAMe:FPOWer<nr>?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:FRAMe:FPOWer<nr>?	Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm	Avg. power in slot <nr>	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return the average power in a particular frame (numbered by <nr>=1 to 128, corresponding to frame 0 to frame 127 of the graphical user interface).	V2.15

P/Slot Graph Results

READ:ARRay:POWer:FRAMe?	Start single shot measurement and return results
FETCh:ARRay:POWer:FRAMe?	Read out measurement results (unsynchronized)
SAMPle:ARRay:POWer:FRAMe?	Read out measurement results (synchronized)

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in slot 0,	NAN,	dBm,	
...	...,	...,	...,	
–100 dBm to 100 dBm	Avg. power in slot Slot 127	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the mobile phone in 128 consecutive timeslots.	V2.15

Subarray Results

READ:SUBarrays:POWer:FRAMe?	Start single shot measurement and return results
FETCh:SUBarrays:POWer:FRAMe?	Read out measurement results (unsynchronized)
SAMPle:SUBarrays:POWer:FRAMe?	Read out measurement results (synchronized)

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100 dBm to 100 dBm,	Avg. power in first slot,	NAN	dB	
...	...,	...	...	
–100 dBm to 100 dBm	Avg. power in last slot	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.15

POWer:MSLot

The subsystem *POWer:MSLot* measures the MS output carrier power versus time in up to 4 consecutive timeslots. The subsystem corresponds to the measurement menu *Power*, application *P/t Multislot*, and the associated popup menu *Power Configuration*.

Note: *The `POWer:MSLot` measurement can not be carried out with a* Free Run *trigger (`TRIGger[:SEQuence]:SOURce FRUN`).*

Control of Measurement – Subsystem POWer:MSLot

The subsystem *POWer:MSLot* controls the P/t multislot measurement.

INITiate:POWer:MSLot	Start new measurement	*RUN*
ABORt:POWer:MSLot	Abort measurement and switch off	*OFF*
STOP:POWer:MSLot	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:MSLot	Next meas. step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V3.05

CONFigure:POWer:MSLot:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).				V3.05

FETCh:POWer:MSLot:STATus?				Measurement Status
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual of CMU manual).				V3.05

Subsystem POWer:MSLot:CONTrol

The subsystem *POWer:MSLot:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MSLot:CONTrol *<Mode>,<Statistics>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
NONE	Statistics off (equivalent to 1)			
Description of command				FW vers.
This command restricts the type of measured values to accelerate the measurement and determines the number of bursts within a statistics cycle.				V3.05

CONFigure:POWer:MSLot:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V3.05

DISPlay:POWer:MSLot:CONTrol:GRID *<Enable>* Grid

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on grid lines	ON	–	–
OFF	Switch off grid lines			
Description of command				FW vers.
This command switches the grid lines in the test diagrams on or off.				V3.05

CONFigure:POWer:MSLot:CONTrol:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	–
OFF	Some or all parameters are not set to default			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V3.05

Test Configuration

The commands of the following subsystems configure the *P/t Multislot* measurement. They correspond to some of the softkey/hotkey combinations in the graphical measurement menu and to some of the settings in the *Power Configuration* popup menu that are related to the *P/t Multislot* measurement.

CONFigure:POWer:MSLot:MVIew *<Mod_-1>,<Mod_0>, <Mod_1>, <Mod_2>* Modulation View

<Mod_1>, ... , <Mod_2>	Description of parameters	Def. value	Def. unit	Unit ring
GMSK |	GMSK modulation required	ANY	–	–
EPSK |	8PSK modulation required			
ANY |	GMSK or 8PSK modulation			
OFF	Inactive timeslot (power off) required			

Description of command	FW vers.
This command defines the modulation schemes and power/time templates for the Meas. Timeslot –1, Meas. Timeslot and the two following timeslots. Values for timeslots that are currently switched off (see command `CONFigure:POWer:MSLot:SCOunt`) are not taken into consideration.	V3.05

CONFigure:POWer:MSLot:SCOunt *<Slots>* Slot Count

<Slots>	Description of parameters	Def. value	Def. unit	Unit ring
1 |	Meas. timeslot (MTS)	2	–	
2 |	MTS – 1, MTS			
3 |	MTS – 1, MTS, MTS + 1			
4	MTS – 1, MTS, MTS + 1, MTS + 2			

Description of command	FW vers.
This command defines the number of timeslots measured and determines the length of the measurement arrays (see `READ:ARRay:POWer:MSLot...` commands). The measured timeslot is defined via `CONFigure:RFANalyzer:MCONtrol:TSOFfset` (Non Signalling) or `CONFigure:MSSignal:MCONtrol:MESLot` (Signalling).	V3.05

CONFigure:POWer:MSLot:TOFFset *<Offset>* Timing Offset

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 to +4.00	Number of bits (in ¼ symbol steps)	0	symb.	

Description of command	FW vers.
This command defines an offset time by which the burst is shifted relative to the time axis and the tolerance template. The values entered are rounded to ¼ symbol steps.	V3.05

CONFigure:POWer:MSLot:FILTer ***<Filter>***				Filter
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500	–	–
Description of command				FW vers.
This command selects the measurement filter for the measurement.				V3.05

CONFigure:POWer:MSLot:LIMit:LINE:GLEVel ***<Level>***				Multislot Guard
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0.00 dB to +10.00 dB	Multislot guard level	3	dB	
Description of command				FW vers.
This command defines the raising of the upper limit line in the guard period between two consecutive bursts.				V3.05

Subsystem SUBarrays:POWer:MSLot

The subsystem *SUBarrays:POWer:MSLot* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:MSLot **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	–
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–180 symbols to +520 symbols	Start time in current range, relative to symbol 0 of the meas. slot	–165	symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 2613	Number of samples in current range, depending on `SCOunt` (see commands `READ:ARRay:POWer:MSLot...`)	2613	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ symbols. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value at the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V3.05

Measured Values

The subsystem *POWer:MSLot...* contains the commands to measure the normal burst power, compare it with the tolerances and retrieve the results. The subsystem corresponds to the graphical measurement menu *Power.*

	Scalar results
READ[:SCALar]:POWer:MSLot?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MSLot?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MSLot?	Read out measurement results (synchronized)

Returned values per timeslot	Value range	Def. value	Def. unit	Unit ring
BurstsOutOfTolerance,	0.0 % to 100.0 %	NAN	%	
AvgBurstPowerCurrent,	–137 dBm to +53 dBm	NAN	dBm	
AvgBurstPwAvg	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPowerCurrent,	–137 dBm to +53 dBm	NAN	dBm	
TimingError,	–100.0 bit to+100.0 bit	NAN	bit	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command	FW vers.
These commands are always queries. - `READ` starts a single shot measurement and returns the results. - `FETCh` returns the results irrespective of the measurement state. - `SAMPle` waits until the results are valid (depending on the statistic count) and then returns the results. For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual. The complete list of results is repeated four times (timeslots 0, –1, +1, +2; see command `CONFigure:POWer:MSLot:SCOunt`).	V3.05

CALCulate:POWer:MSLot:LIMit:MATChing? Limit Matching

Returned values per timeslot	Value range	Def. value	Def. unit	Unit ring
AvgBurstPowerCurrent,	NMAU | NMAL | INV | OK	INV	–	–
AvgBurstPwAvg	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPowerCurrent,	NMAU | NMAL | INV | OK	INV	–	
TimingError,	OK (no limit check)	INV	—	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV		

Description of command — FW vers. V3.05

This command is always a query. It indicates whether and in which way the permissible tolerances for the scalar measured values (see command above) have been exceeded. The following messages may be output for the values *AvgBurstPowerCurr, PeakBurstPowerCurr* and *AvgBurstPowerAvg*:

OK	Tolerance value matched	*OK.*
NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measured value invalid	*invalid*

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

The complete list of results is repeated four times (timeslots 0, –1, +1, +2; see command `CONFigure:POWer:MSLot:SCOunt`).

READ:ARRay:POWer:MSLot[:CURRent]? Burst Power
READ:ARRay:POWer:MSLot:AVERage?
READ:ARRay:POWer:MSLot:MAXimum?
READ:ARRay:POWer:MSLot:MINimum? Start single shot measurement and return results
FETCh:ARRay:POWer:MSLot[:CURRent]?
FETCh:ARRay:POWer:MSLot:AVERage?
FETCh:ARRay:POWer:MSLot:MAXimum?
FETCh:ARRay:POWer:MSLot:MINimum? Read measurement results (unsynchronized)
SAMPle:ARRay:POWer:MSLot[:CURRent]?
SAMPle:ARRay:POWer:MSLot:AVERage?
SAMPle:ARRay:POWer:MSLot:MAXimum?
SAMPle:ARRay:POWer:MSLot:MINimum? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1]	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[n]	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the burst power relative to the average burst power in the measurement slot at n equidistant measurement points with a fixed ¼ symbol spacing. The time range measured corresponds to 1 to 4 entire timeslots plus 18 ¼ symbol periods before the beginning (symbol 0) of the first slot and 10 symbol periods after the end of the last slot. The resulting array lengths n are listed below.	V3.05

Number of timeslots (according to `CONFigure:POWer:MSLot:SCOunt`)	1	2	3	4
n	738	1363	1988	2613

READ:SUBarrays:POWer:MSLot[:CURRent]? Subarray Results
READ:SUBarrays:POWer:MSLot:AVERage?
READ:SUBarrays:POWer:MSLot:MAXimum?
READ:SUBarrays:POWer:MSLot:MINimum?
Start single shot measurement and return results *RUN*

FETCh:SUBarrays:POWer:MSLot[:CURRent]?
FETCh:SUBarrays:POWer:MSLot:AVERage?
FETCh:SUBarrays:POWer:MSLot:MAXimum?
FETCh:SUBarrays:POWer:MSLot:MINimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:SUBarrays:POWer:MSLot[:CURRent]?
SAMPle:SUBarrays:POWer:MSLot:AVERage?
SAMPle:SUBarrays:POWer:MSLot:MAXimum?
SAMPle:SUBarrays:POWer:MSLot:MINimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1]	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[m]	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the burst power relative to the average burst power in the measurement slot in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V3.05

CALCulate:ARRay:POWer:MSLot:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MINimum?

Global Burst Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
Matching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	–

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the burst power (see command above) in all measured timeslots have been exceeded.	V3.05

The following messages may be output for the value *Matching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MINimum?

Area Limit Matching

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
32 bit value,	Indicator for upper limit matching in area 1 to n	NAN	–	–
32 bit value	Indicator for lower limit matching in area 1 to n	NAN	–	–

Description of command	FW vers.
This command is always a query. A bit in the two output values is set if the corresponding section of the limit lines is exceeded. n ≤ 32 is the total number of areas in the limit lines, depending on the number of bursts measured (according to `CONFigure:POWer:MSLot:SCOunt`).	V3.05

MODulation[:PERRor]

The subsystem *MODulation[:PERRor][:GMSK]* measures the modulation parameters (frequency and phase errors) in GMSK modulation. The subsystem corresponds to the measurement menu *Modulation*, application *Ext. Phase Err. GMSK*, and the associated popup menu *Modulation Config*, however, it does not provide the I/Q Imbalance and the Origin Offset in the I/Q constellation diagram.

If results for the I/Q Imbalance and the Origin Offset are needed, the slower *MODulation:XPERror* measurement must be used; see p. 6.64 ff.

Note: GMSK and 8PSK modulation

The keywords `[:GMSK]` *and* `:EPSK` *in the remote control commands denote GMSK and 8PSK modulation, respectively. The* `:EPSK` *commands in Signalling measurements are included in firmware versions V3.05 and higher. The firmware version numbers quoted in the command tables refer either to GMSK modulation or EPSK modulation in Non Signalling mode.*

Control of Measurement – Subsystem MODulation[:PERRor][:GMSK]

The subsystem *MODulation[:PERRor][:GMSK]* controls the modulation measurement. It corresponds to the softkey *Ext. Phase Err. GMSK* in the measurement menu *Modulation*.

INITiate:MODulation[:PERRor][:GMSK]	Start new measurement	*RUN*
ABORt:MODulation[:PERRor][:GMSK]	Abort running measurement and switch off	*OFF*
STOP:MODulation[:PERRor][:GMSK]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation[:PERRor][:GMSK]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting*, see chapter 5 of CMU manualCMU manual).				≥1.15

FETCh:MODulation[:PERRor][:GMSK]:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:FILTer *<Filter>* Filter

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
G500 |	500 kHz Gaussian filter	G500	–	–
B600	600 kHz bandpass filter			

Description of command	FW vers.
This command selects the measurement filter for the `XPERror[:GMSK]` modulation measurement.	V3.05

Subsystem MODulation[:PERRor][:GMSK]:CONTrol

The subsystem *MODulation[:PERRor][:GMSK]:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Config*.

Scope of Measurement

CONFigure:MODulation[:PERRor][:GMSK]:CONTrol *<Mode>, <Statistics>*

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Only scalar measured values (incl. tolerance matching)	ARRay	–	
ARRay	Scalar measured values and arrays			
<Statistics>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 1000 |	No. of bursts within a statistics cycle	100	–	
NONE	Statistics off			

Description of command	FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.	≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:REPetition Test Cycles
<Repetition> ,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	

Tolerance values – Subsystem MODulation[:PERRor][:GMSK]:LIMit

The subsystem *MODulation[:PERRor][:GMSK]:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation Configuration.*

CONFigure:MODulation[:PERRor][:GMSK]:LIMit[:CURRent] Upper Modulation Errors
<PhaseErrorPeak>,<PhaseErrorRMS>,<FrequencyError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg	PhaseErrorPeak	+20.0	deg	Angle
0.0 deg to +50.0 deg	PhaseErrorRMS	+5.0	deg	
0.0 Hz to +999 Hz	FrequencyError	+90	Hz	

Description of command	FW vers.
This command defines limits for the peak and RMS phase error as well as for the frequency error in the current or maximum trace. The default frequency error is 49 Hz for GSM400, 90 Hz for GSM850 and GSM900, 180 Hz for GSM1800, 190 Hz for GSM1900. Besides, the ranges and default values for the upper and lower *PhaseErrorPeak* and *FrequencyError* limits have equal magnitude but different sign.	≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:LIMit:UPPer:MODE *<Mode>* Upper Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Upper limit check on Upper limit check off	ON	–	–

Description of command	FW vers.
This command switches on or off the tolerance check with respect to the upper limit lines (current and average).	≥2.0

CONFigure:MODulation[:PERRor][:GMSK]:LIMit:LOWer:MODE <Mode> Lower Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Lower limit check on Lower limit check off	ON	–	–

Description of command	FW vers.
This command switches on or off the tolerance check with respect to the lower limit lines (current and average).	≥2.0

CONFigure:MODulation[:PERRor][:GMSK]:LIMit:AVERage Upper Average Limits
<PhaseErrorPeak>, <PhaseErrorRMS>,<FrequencyError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 to +50.0 deg	PhaseErrorPeak	+20.0	deg	
0.0 to +50.0 deg	PhaseErrorRMS	+5.0	deg	
0.0 to +999 Hz	FrequencyError	+90	Hz	

Description of command	FW vers.
This command defines limits for the peak and RMS phase error as well as for the frequency error in the average trace. The default frequency error is 49 Hz for GSM400, 90 Hz for GSM850 and GSM900, 180 Hz for GSM1800, 190 Hz for GSM1900. Besides, the ranges and default values for the upper and lower *PhaseErrorPeak* and *FrequencyError* limits have equal magnitude but different sign.	≥1.15

CONFigure:MODulation[:PERRor][:GMSK]:LIMit:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	

Subsystem MODulation...:TIME

The subsystem *MODulation...:TIME* defines the decoding for the *Modulation* measurement. The subsystem corresponds to the *Decode* hotkey in the graphical measurement menu *Modulation.*

CONFigure:MODulation[:PERRor][:GMSK]:TIME:DECode <*Mode*>				Decode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
STANdard | **GTBits**	The standard bit range is decoded The guard and tail bits are also decoded	GTBits	–	–
Description of command				FW vers.
This command selects the type of decoding applied for the determination of phase and frequency errors.				V2.15

Subsystem SUBarrays:MODulation[:PERRor][:GMSK]

The subsystem *SUBarrays:MODulation[:PERRor][:GMSK]* defines the measurement range and the type of returned values.

CONFigure:SUBarrays:MODulation[:PERRor][:GMSK] **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 588	Number of samples in current range	588	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *MODulation[:PERRor][:GMSK]* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				2.0

Measured Values – Subsystem MODulation[:PERRor][:GMSK]?

The subsystem *MODulation[:PERRor][:GMSK]* measures and returns the modulation results and compares them with the tolerance values. The subsystem corresponds to the various output elements in the graphical measurement menu *MODulation[:PERRor][:GMSK]*.

	Scalar Results:
READ[:SCALar]:MODulation[:PERRor][:GMSK]?	Start single shot meas. and return results
FETCh[:SCALar]:MODulation[:PERRor][:GMSK]?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation[:PERRor][:GMSK]?	Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
FreqErrMaxMin,	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all scalar measurement results (see chapter 5). These are:	≥1.15

Peak phase error of current burst	*phase error peak current*
Peak phase error of average measurement	*phase error peak average*
Peak phase error of peak measurement	*phase error peak max./min.*
Rms phase error of current burst	*phase error RMS current*
Rms phase error of average measurement	*phase error RMS average*
Rms phase error of peak measurement	*phase error RMS max./min.*
Frequency error of current burst	*frequency error current*
Frequency error of average measurement	*frequency error average*
Frequency error of peak measurement	*frequency error max./min.*
Average burst power of current burst	*avg. burst power current*
Relative portion of faulty bursts	*bursts out of tolerance*

The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).

CALCulate:MODulation[:PERRor][:GMSK]:LIMit:MATChing? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrPeakCurrent,		INV	–	
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,	**For all measured values:**	INV	–	
PhErrRMSCurrent,		INV	–	
PhErrRMSAverage,		INV	–	
PhErrRMSMaxMin,	**NMAU | NMAL | INV | OK**	INV	–	
FreqErrCurrent,		INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin,		INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The following messages may be returned for all measured values:	≥1.15

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation[:PERRor][:GMSK][:CURRent]? Phase Error in Burst
READ:ARRay:MODulation[:PERRor][:GMSK]:AVERage?
READ:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?
FETCh:ARRay:MODulation[:PERRor][:GMSK]:AVERage?
FETCh:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:AVERage?
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	dB	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the phase error of the burst vs. time in a fixed ¼ bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (cf. *display mode*).	≥1.15

READ:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]? Subarray Results
READ:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?
READ:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	dB	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the phase error versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation[:PERRor][:GMSK]` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation[:PERRor][:GMSK]` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.0

MODulation:XPERror

The subsystem *MODulation:XPERror[:GMSK]* measures the modulation parameters (frequency and phase errors) in GMSK modulation including the I/Q Imbalance and the Origin Offset in the I/Q constellation diagram. The subsystem corresponds to the measurement menu *Modulation*, application *Ext. Phase Err. GMSK,* and the associated popup menu *Modulation Configuration.*

If no results for the I/Q Imbalance and the Origin Offset are needed, it is recommended to use the faster *MODulation[:PERRor]* measurement; see p.6.56 ff.

Control of Measurement – Subsystem MODulation:XPERror[:GMSK]

The subsystem *MODulation:XPERror[:GMSK]* controls the modulation measurement. It corresponds to the softkey *Ext. Phase Err. GMSK* in the measurement menu *Modulation*.

INITiate:MODulation:XPERror[:GMSK]	Start new measurement	*RUN*
ABORt:MODulation:XPERror[:GMSK]	Abort running measurement and switch off	*OFF*
STOP:MODulation:XPERror[:GMSK]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:XPERror[:GMSK]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.15

CONFigure:MODulation:XPERror[:GMSK]:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V2.15

FETCh:MODulation:XPERror[:GMSK]:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode <*Mode*> Decode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
STANdard | **GTBits**	The standard bit range is decoded The guard and tail bits are also decoded	GTBits	–	–

Description of command	FW vers.
This command selects the type of decoding applied for the determination of phase and frequency errors.	V2.15

CONFigure:MODulation:XPERror[:GMSK]:FILTer <*Filter*> Filter

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
G500 | **B600**	500 kHz Gaussian filter 600 kHz bandpass filter	G500	–	–

Description of command	FW vers.
This command selects the measurement filter for the `XPERror[:GMSK]` modulation measurement.	V3.05

Subsystem MODulation:XPERror[:GMSK]:CONTrol

The subsystem *MODulation:XPERror[:GMSK]:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Config*.

CONFigure:MODulation:XPERror[:GMSK]:CONTrol <*Mode*>, <*Statistics*> Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	

Description of command	FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.	V2.15

CONFigure:MODulation:XPERror[:GMSK]:CONTrol:REPetition
<Repetition> ,<StopCond>,<Stepmode> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring

STEP |	Interrupt measurement after each statistics cycle	NONE	–	
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.15

CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.15

Tolerance values – Subsystem MODulation:XPERror[:GMSK]:LIMit

The subsystem *MODulation:XPERror[:GMSK]:LIMit* defines tolerance values for the modulation measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Modulation*.

CONFigure:MODulation:XPERror[:GMSK]:LIMit[:CURRent] Current & Max. Errors
<PhaseErrorPeak>,<PhaseErrorRMS>,<OrigOffs>,<IQImb>,<FrequencyError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg	Phase Error Peak	+20.0	deg	
0.0 deg to +50.0 deg	Phase Error RMS	+5.0	deg	
–100.0 dB to 0 dB	Origin Offset	–20	dB	
–100.0 dB to 0 dB	I/Q Imbalance	–20	dB	
0.0 Hz to +999 Hz	Frequency Error	+90	Hz	

Description of command	FW vers.
This command defines limits for the modulation parameters in the *Current* or *Max./Min.* trace. For quantities with alternating sign (the *Phase Error Peak* and the *Frequency Error)*, the absolute value must fall below the specified limit. The default frequency error is 49 Hz for GSM400, 90 Hz for GSM850 and GSM900, 180 Hz for GSM1800, 190 Hz for GSM1900.	V2.15

CONFigure:MODulation:XPERror[:GMSK]:LIMit:AVERage Average Errors
<PhaseErrorPeak>,<PhaseErrorRMS>,<OrigOffs>,<IQImb>,<FrequencyError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg	Phase Error Peak	+20.0	deg	
0.0 deg to +50.0 deg	Phase Error RMS	+5.0	deg	
–100.0 dB to 0 dB	Origin Offset	–20	dB	
–100.0 dB to 0 dB	I/Q Imbalance	–20	dB	
0.0 Hz to +999 Hz	Frequency Error	+90	Hz	

Description of command	FW vers.
This command defines limits for the modulation parameters in the *Average* trace. For quantities with alternating sign (the *Phase Error Peak* and the *Frequency Error)*, the absolute value must fall below the specified limit. The default frequency error is 49 Hz for GSM400, 90 Hz for GSM850 and GSM900, 180 Hz for GSM1800, 190 Hz for GSM1900.	V2.15

CONFigure:MODulation:XPERror[:GMSK]:LIMit:UPPer:MODE *<Mode>* Upper Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Upper limit check on	ON	–	–
OFF	Upper limit check off			

Description of command	FW vers.
This command switches on or off the tolerance check with respect to the upper limit lines (current and average).	V2.15

CONFigure:MODulation:XPERror[:GMSK]:LIMit:LOWer:MODE <Mode> Lower Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Lower limit check on	ON	–	–
OFF	Lower limit check off			

Description of command	FW vers.
This command switches on or off the tolerance check with respect to the lower limit lines (current and average).	V2.15

CONFigure:MODulation:XPERror[:GMSK]:LIMit:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.15

Subsystem SUBarrays:MODulation:XPERror[:GMSK]

The subsystem *SUBarrays:MODulation:XPERror[:GMSK]* defines the measurement range and the type of output values.

**CONFigure:SUBarrays:MODulation:XPERror[:GMSK]
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 588	Number of samples in current range	588	–	

Description of command | FW vers.: V2.15

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:XPERror[:GMSK]` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>.

For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *MODulation:XPERror[:GMSK]* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:XPERror[:GMSK]

The subsystem *MODulation:XPERror[:GMSK]* measures and returns the modulation results and compares them with the tolerance values. The subsystem corresponds to the various output elements in the graphical measurement menu *MODulation:XPERror[:GMSK].*

	Scalar Results:
READ[:SCALar]:MODulation:XPERror[:GMSK]?	Start single shot meas. and return results
FETCh[:SCALar]:MODulation:XPERror[:GMSK]?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:XPERror[:GMSK]?	Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
Phase Err. Peak Current,	–100.0° to +100.0°	NAN	deg	
Phase Err. Peak Average,	–100.0° to +100.0°	NAN	deg	
Phase Err. Peak MaxMin,	–100.0° to +100.0°	NAN	deg	
Phase Err. RMS (x3),	–100.0° to +100.0°	NAN	deg	
Origin Offset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
I/Q Imbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
Frequency Error (x3),	–1000.0 Hz to +1000.0 Hz	NAN	deg	
AvgBurstPowerCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	
Phase of Origin Offset Vector	–180° to +180°	NAN	deg	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all scalar measurement results (see chapter 5). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMAX* curve. The phase of the origin offset vector, which is measured relative to the phase of the 3rd test point in the *Modulation* trace (bit ½), can be retrieved in remote control only. The origin offset vector in the I/Q plane is thus completely determined by its phase and its magnitude (i.e. the quantity *Origin Offset).* The calculation of results in an *average* or *peak* measurement is described in chapter 3 (cf. *calculation of statistical quantities*).	V2.15

CALCulate:MODulation:XPERror[:GMSK]:LIMit:MATChing? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
Phase Err. Peak Current,		INV	–	
Phase Err. Peak Average,		INV	–	
Phase Err. Peak MaxMin,	**For all measured values:**	INV	–	
Phase Err. RMS (x3),		INV	–	
Origin Offset (x3),		INV	–	
I/Q Imbalance (x3),		INV	–	
Frequency Error (x3),	**NMAU | NMAL | INV | OK**	INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded.	V2.15

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:XPERror[:GMSK][:CURRent]? Phase Error in Burst
READ:ARRay:MODulation:XPERror[:GMSK]:AVERage?
READ:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:XPERror[:GMSK][:CURRent]?
FETCh:ARRay:MODulation:XPERror[:GMSK]:AVERage?
FETCh:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:XPERror[:GMSK][:CURRent]?
SAMPle:ARRay:MODulation:XPERror[:GMSK]:AVERage?
SAMPle:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	dB	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the phase error of the burst vs. time in a fixed ¼-bit pattern. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (cf. *display mode*).	V2.15

READ:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]? Subarray Results
READ:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?
READ:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?
Start single shot measurement and return results *RUN*

FETCh:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	dB	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the phase error versus time in a fixed ¼-bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:XPERror[:GMSK]` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:XPERror[:GMSK]` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V2.15

MODulation[:OVERview]

The subsystem *MODulation[:OVERview]:EPSK* measures general scalar modulation parameters in 8PSK modulation. The subsystem corresponds to the measurement menu *Modulation*, application *Overview 8PSK*, and the associated popup menu *Modulation Configuration*.

Control of Measurement – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* controls the modulation measurement. It corresponds to the softkey *Overview 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:EPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:OVERview:EPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:OVERview:EPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:OVERview:EPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.15

CONFigure:MODulation:OVERview:EPSK:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).				V2.15

FETCh:MODulation:OVERview:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview* application.

Subsystem MODulation:OVERview:EPSK:CONTrol

The subsystem *MODulation:OVERview:EPSK:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:EPSK:CONTrol ***<Mode>, <Statistics>***

Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	SCALar	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	

Description of command	FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.	V2.15

CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition
<Repetition> ,<StopCond>,<Stepmode>

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.15

CONFigure:MODulation:OVERview:EPSK:CONTrol:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command — FW vers. V2.15

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message).

If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* defines tolerance values for the modulation measurement **in all four 8PSK applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent] Limits Current & Max
<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +50.0 %,	EVMErrorPeak	+17.7	%	
0.0 % to +50.0 %,	EVMErrorRMS	+12.5	%	
0.0 % to +50.0 %,	MagnErrorPeak	+17.7	%	
0.0 % to +50.0 %,	MagnErrorRMS	+12.5	%	
0.0 deg to +180.0 deg,	PhaseErrorPeak	+20.0	deg	
0.0 deg to +180.0 deg,	PhaseErrorRMS	+5.0	deg	
–100.0 dB to +0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to +0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 999 Hz	FrequencyError	+300	Hz	

Description of command — FW vers. V2.15

This command defines upper limits for the *Current* and *Max./Min*. traces and for the scalar modulation parameters derived from them.

CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage Limits Average
<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to +50.0 %,	EVMErrorPeak	+17.7	%	
0.0 % to +50.0 %,	EVMErrorRMS	+12.5	%	
0.0 % to +50.0 %,	MagnErrorPeak	+17.7	%	
0.0 % to +50.0 %,	MagnErrorRMS	+12.5	%	
0.0 deg to +180.0 deg,	PhaseErrorPeak	+20.0	deg	
0.0 deg to +180.0 deg,	PhaseErrorRMS	+5.0	deg	
–100.0 dB to +0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to +0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 999 Hz	FrequencyError	+300	Hz	

Description of command — FW vers. V2.15

This command defines upper limits for the *Average* traces and for the scalar modulation parameters derived from them.

CONFigure:MODulation:OEMP:EPSK:LIMit:P95Th 95th Percentile

<EVM95%>, <MError95%>, <PError95%>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0% to 50.0%,	95th percentile EVM	+5.0	%	
0% to 50.0%,	95th percentile modulation error	+5.0	%	
0° to +180°	95th percentile phase error	+5.0	deg	

Description of command	FW vers.
This command defines upper limits for the 95th percentile of the three quantities *error vector magnitude*, *modulation error*, and *phase error*. The 95th percentile is the limit below which 95% of the measured errors are located.	V2.15

CONFigure:MODulation:OEMP:EPSK:LIMit:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.15

Measured Values – Subsystem MODulation:OVERview:EPSK

The subsystem *MODulation:OVERview:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation*, application *Overview 8PSK*.

READ[:SCALar]:MODulation:OVERview:EPSK? Scalar Results: Start single shot measurement and return results

FETCh[:SCALar]:MODulation:OVERview:EPSK? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:OVERview:EPSK? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,	0.0 % to 100.0 %	NAN	%	
95thPercentileMagErr,	0.0 % to 100.0 %	NAN	%	
95thPercentilePhErr,	–100.0 deg to +100.0 deg	NAN	deg	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorPeak(x3),	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.15

CALCulate:MODulation:OVERview:EPSK:LIMit:MATChing?

Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileEVM,		INV	–	
95thPercentileMagErr,		INV	–	
95thPercentilePhErr,		INV	–	
EVMPeak (x3),	**For all measured values:**	INV	–	
EVMRMS (x3),		INV	–	
MagnErrorPeak (x3),		INV	–	
MagnErrorRMS (x3),		INV	–	
PhErrorPeak(x3),	**NMAU |NMAL | INV | OK**	INV	–	
PhErrorRMS (x3),		INV	–	
OriginOffset (x3),		INV	–	
IQImbalance (x3),		INV	–	
FrequencyError (x3),		INV	–	
AvgBurstPowerCurr		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.15

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation*, application *EVM 8PSK*, and the associated popup menu *Modulation Configuration*.

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:EPSK	Start new measurement	⇒	*RUN*
ABORt:MODulation:EVMagnitude:EPSK	Abort running measurement and switch off	⇒	*OFF*
STOP:MODulation:EVMagnitude:EPSK	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:MODulation:EVMagnitude:EPSK	Next meas. step (only *stepping mode*)	⇒	*RUN*
Description of command			FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.			V2.15

CONFigure:MODulation:EVMagnitude:EPSK:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).				V2.15

FETCh:MODulation:EVMagnitude:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude:EPSK:CONTrol

The subsystem *MODulation:EVMagnitude:EPSK:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol *<Mode>, <Statistics>*

Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Only scalar measured values (incl. tolerance matching)	ARRay	–	
ARRay	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	No. of bursts within a statistics cycle	100	–	
NONE	Statistics off			
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V2.15

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	
NONE	Continue measurement according to its rep. mode			
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.15

CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:DEFault *<Enable>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.15

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.74 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 588	Number of samples in current range	588	–	

Description of command — FW vers. V2.15

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>.

For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:EVMagnitude:EPSK

The subsystem *MODulation:EVMagnitude:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation*, application *EVM 8PSK*.

	Scalar Results:
READ[:SCALar]:MODulation:EVMagnitude:EPSK?	Start single shot meas. and return results
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?	Read out meas. results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95th Percentile EVM	0.0 % to 100.0 %	NAN	%	
EVM Peak (x3),	0.0 % to 100.0 %	NAN	%	
EVM RMS (x3),	0.0 % to 100.0 %	NAN	%	
Origin Offset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQ Imbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
Frequency Error (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
Avg Burst Power Curr,	–137 dBm to +53 dBm	NAN	dBm	
Bursts Out Of Tol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4). The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value.	V2.15

CALCulate:MODulation:EVMagnitude:EPSK:LIMit:MATChing?	Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95th Percentile EVM		INV	–	
Ph Error Peak (x3),		INV	–	
Ph Error RMS (x3),	**For all measured values:**	INV	–	
		INV	–	
Origin Offset (x3),	**NMAU | NMAL | INV | OK**			
IQ Imbalance (x3),		INV	–	
Frequency Error(x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.	V2.15

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]? Phase Error in Burst
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for error vector magnitude	NAN	%	

Description of command FW vers.

These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit. V2.15

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for error vector magnitude	NAN	%	

Description of command FW vers.

These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. V2.15

The `CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

MODulation:PERRor

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation*, application *Phase Error 8PSK*, and the associated popup menu *Modulation Configuration*.

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation[:PERRor]:EPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation[:PERRor]:EPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation[:PERRor]:EPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation[:PERRor]:EPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V2.15

CONFigure:MODulation[:PERRor]:EPSK:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).	V2.15

FETCh:MODulation[:PERRor]:EPSK:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	V2.15

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Phase Error* application.

Subsystem MODulation[:PERRor]:EPSK:CONTrol

The subsystem *MODulation[:PERRor]:EPSK:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation[:PERRor]:EPSK:CONTrol *<Mode>, <Statistics>*				Scope of Measurement
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V2.15

CONFigure:MODulation[:PERRor]:EPSK:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>*				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.15

CONFigure:MODulation[:PERRor]:EPSK:CONTrol:DEFault *<Enable>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.15

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.74 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation[:PERRor]:EPSK

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation[:PERRor]:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 588	Number of samples in current range	588	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation[:PERRor]:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.15

Measured Values – Subsystem MODulation[:PERRor]:EPSK

The subsystem *MODulation[:PERRor]:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Phase Error 8PSK.*

	Scalar Results:
READ[:SCALar]:MODulation[:PERRor]:EPSK?	Start single shot meas. and return results
FETCh[:SCALar]:MODulation[:PERRor]:EPSK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation[:PERRor]:EPSK?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhase Error	0.0 % to 100.0 %	NAN	%	
PhErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
PhErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.15

CALCulate:MODulation[:PERRor]:EPSK:LIMit:MATChing?		Bursts out of Tolerance		
Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentilePhError		INV	–	
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),	**NMAU | NMAL | INV | OK**			
IQImbalance (x3),		INV	–	
FrequencyError(x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP...` commands. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	V2.15

READ:ARRay:MODulation[:PERRor]:EPSK[:CURRent]? Phase Error in Burst
READ:ARRay:MODulation[:PERRor]:EPSK:AVERage?
READ:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?
FETCh:ARRay:MODulation[:PERRor]:EPSK:AVERage?
FETCh:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?
SAMPle:ARRay:MODulation[:PERRor]:EPSK:AVERage?
SAMPle:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	deg	

Description of command — FW vers. V2.15

These commands are always queries. They return the phase error vs. time at fixed, equidistant test points. The number of measured values is 588, corresponding to a time range of 0 bit to 146 ¾ bit.

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]? Subarray Results
READ:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?
READ:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	deg	

Description of command — FW vers. V2.15

These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation[:PERRor]:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation[:PERRor]:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation*, application *Magn. Error 8PSK*, and the associated popup menu *Modulation Configuration*.

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error 8PSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:EPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:EPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:MERRor:EPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:EPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.15

CONFigure:MODulation:MERRor:EPSK:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped (*event reporting*, see chapter 5 of CMU manual).				V2.15

FETCh:MODulation:MERRor:EPSK:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.15

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magnitude Error* application.

Subsystem MODulation:MERRor:EPSK:CONTrol

The subsystem *MODulation:MERRor:EPSK:CONTrol* configures the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:MERRor:EPSK:CONTrol *<Mode>, <Statistics>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Only scalar measured values (incl. tolerance matching)	ARRay	–	
ARRay	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	No. of bursts within a statistics cycle	100	–	
NONE	Statistics off			

Description of command	FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.	V2.15

CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.15

CONFigure:MODulation:MERRor:EPSK:CONTrol:DEFault *<Enable>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.15

Tolerance values – Subsystem MODulation:OEMP:EPSK:LIMit

The subsystem *MODulation:OEMP:EPSK:LIMit* (see p. 6.74 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum |	Return maximum value in every range			
IVAL,	Return single interpolated value at <Start>			
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 bit to 146 ¾ bit,	Start time in current range	0	bit	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 588	Number of samples in current range	588	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor:EPSK` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.15

Measured Values – Subsystem MODulation:MERRor:EPSK

The subsystem *MODulation:MERRor:EPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Magn. Error 8PSK.*

Scalar Results:

READ[:SCALar]:MODulation:MERRor:EPSK?	Start single shot meas. and return results
FETCh[:SCALar]:MODulation:MERRor:EPSK?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor:EPSK?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr	0.0 % to 100.0 %	NAN	%	
MErrPeak (x3),	0.0 % to 100.0 %	NAN	%	
MErrRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
AvgBurstPowerCurr,	–137 dBm to +53 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.15

CALCulate:MODulation:MERRor:EPSK:LIMit:MATChing? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
95thPercentileMErr		INV	–	
MErrPeak (x3),		INV	–	
MErrRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU | NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.

FW vers. V2.15

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:MERRor:EPSK[:CURRent]? Phase Error in Burst
READ:ARRay:MODulation:MERRor:EPSK:AVERage?
READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:MERRor:EPSK[:CURRent]?
FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?
FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:MERRor:EPSK[:CURRent]?
SAMPle:ARRay:MODulation:MERRor:EPSK:AVERage?
SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for magnitude error	NAN	%	

Description of command FW vers.

These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points. The number of measured values is 588, corresponding to a time range of 0 bit to 146 3/4 bit. V2.15

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:MERRor:EPSK[:CURRent]? Subarray Results
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for magnitude error	NAN	%	

Description of command FW vers.

These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor:EPSK` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. V2.15

The `CONFigure:SUBarrays:MODulation:MERRor:EPSK` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.

The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).

SPECtrum:MODulation

The subsystem *SPECtrum:MODulation[:GMSK]* measures the off-carrier power due to the modulation of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum,* application *due to Modulation,* and the associated configuration popups.

***Note:* GMSK and 8PSK modulation**

The keywords `[:GMSK]` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands in Signalling measurements are included in firmware versions V3.05 and higher. The firmware version numbers quoted in the command tables refer either to GMSK modulation or EPSK modulation in Non Signalling mode.

Control of Measurement – Subsystem SPECtrum:MODulation[:GMSK]

The subsystem *SPECtrum:MODulation[:GMSK]* controls the spectrum due to modulation measurement.

INITiate:SPECtrum:MODulation[:GMSK] **INITiate:SPECtrum:MODulation:EPSK**	Start new measurement	⇒ *RUN*
ABORt:SPECtrum:MODulation[:GMSK] **ABORt:SPECtrum:MODulation:EPSK**	Abort running meas. and switch off	⇒ *OFF*
STOP:SPECtrum:MODulation[:GMSK] **STOP:SPECtrum:MODulation:EPSK**	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:SPECtrum:MODulation[:GMSK] **CONTinue:SPECtrum:MODulation:EPSK**	Next meas. step (only *stepping mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V1.20

CONFigure:SPECtrum:MODulation[:GMSK]:EREPorting <*Mode*>
CONFigure:SPECtrum:MODulation:EPSK:EREPorting <*Mode*> Event Reporting

<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V1.20

FETCh:SPECtrum:MODulation[:GMSK]:STATus?
FETCh:SPECtrum:MODulation:EPSK:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	V1.20

Subsystem SPECTrum:MODulation:CONTrol

The subsystem *SPECtrum:MODulation:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control tab* in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol *<Mode>,<Statistics>*
CONFigure:SPECtrum:MODulation:EPSK:CONTrol *<Mode>,<Statistics>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Only scalar measured values	ARRay	–	
ARRay	Scalar measured values and arrays			
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 |	Number of bursts per statistics cycle	200	–	
NONE	Statistics off (equivalent to 1)			

Description of command	FW vers.
This command restricts the type of measured values and determines the number of bursts within a statistics cycle.	V1.20

CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:REPetition Test cycles
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:REPetition
<Repetition>,<StopCondition>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V1.20

DISPlay:SPECtrum:MODulation[:GMSK]:CONTrol:GRID *<Enable>*
DISPlay:SPECtrum:MODulation:EPSK:CONTrol:GRID *<Enable>* Grid

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on grid lines	ON	–	
OFF	Switch off grid lines			

Description of command	FW vers.
This command switches the grid lines in the test diagrams on or off.	V1.20

CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:MPOint<nr>:ENABle <Enable>
Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on measurement point <nr>	ON	–	
OFF	Switch off measurement point <nr>			

Description of command	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 11 (numbered by the numeric suffix <nr>) on or off. Each number denotes a pair of frequency points symmetric to the carrier, <nr>=1 corresponding to ±0.1 MHz, <nr>=11 to ±1.8 MHz.	V1.20

CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:DEFault *<Enable>*
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem are set to default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			

Description of command	FW vers.
If used as a setting command with the parameter *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* causes an error message). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	2.0

Test Configuration

The commands of the following subsystems configure the spectrum due to modulation. They correspond to the *due to Modulation* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:MODulation:LIMit:LINE

The subsystem *SPECtrum:MODulation:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum due to modulation measurement The subsystem corresponds to the *due to Modulation* sections in the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle
<Enable>
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr> Limits
<MinPwLevelRel>, <MaxPwLevelRel>, <AbsPwLevel>, <Enable>

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to11	Measurement point (frequency) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Defined frequency on/off	ON
<MinPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power below the interpolation range	See below
<MaxPwLevelRel>,	–99.9 dB to 99.9 dB	Limit for relative power above the interpolation range	See below
<AbsPwLevel>,	–99.9 dBm to 99.9 dBm	Alternative absolute power limit	
<Enable>	ON | OFF	Enable or disable limit check for frequency point <nr>	See below

Description of command	FW vers.
These commands activate and define limit lines for the spectrum due to modulation measurement. Each number <nr> denotes a pair of frequency points symmetric to the carrier, <nr>=1 corresponding to ±0.1 MHz, <nr>=11 to ±1.8 MHz.	V1.20

The limits are defined at up to 11 fixed frequencies numbered by the numeric suffix <nr> and as a function of the MS output power level. Outside the interpolation range defined via `CONFigure:SPECtrum:MODulation:LIMit:LINE :REFPower[:UPPer]`, the fixed relative power limits *<MinPwLevelRel> and <MaxPwLevelRel>* apply. Inside this range, the limits are derived from these values by linear interpolation. As an alternative, an absolute power limit is set. For a more detailed explanation see chapter 4.

To switch on or off the complete limit check please use the command

```
CONFigure:SPECtrum:MODulation:LIMit:LINE:MODE[:UPPer] <Mode>
```

Default values for GSM400/900 in both modulation schemes:

Frequency	Min.P. Lev.rel.	Max.P. Lev.rel.	Level abs.
± 0.10 MHz	+0.5 dB	+ 0.5 dB	– 36.0 dBm
± 0.20 MHz	–30.0 dB	– 30.0 dB	– 36.0 dBm
± 0.25 MHz	–33.0 dB	– 33.0 dB	– 36.0 dBm
± 0.40 MHz	–60.0 dB	– 60.0 dB	– 36.0 dBm
± 0.60 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 0.80 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 1.00 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 1.20 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 1.40 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 1.60 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm
± 1.80 MHz	–60.0 dB	– 66.0 dB	– 51.0 dBm

Default values for GSM1800/1900 in both modulation schemes:

Frequency	Min.P. Lev.rel.	Max.P. Lev.rel.	Level abs.
± 0.10 MHz	+0.5 dB	+ 0.5 dB	– 36.0 dBm
± 0.20 MHz	–30.0 dB	– 30.0 dB	– 36.0 dBm
± 0.25 MHz	–33.0 dB	– 33.0 dB	– 36.0 dBm
± 0.40 MHz	–60.0 dB	– 60.0 dB	– 36.0 dBm
± 0.60 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 0.80 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 1.00 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 1.20 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 1.40 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 1.60 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm
± 1.80 MHz	–60.0 dB	– 60.0 dB	– 56.0 dBm

CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:REFPower[:UPPer]
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:REFPower[:UPPer] Reference Power
<Minimum>, <Maximum>

<Minimum>	Description of parameters	Def. value	Def. unit	Unit ring
–99.9 dBm to +38.0 dBm	Ref. power for min. power level	33	dBm	–
<Maximum>	Description of parameters	Def. value	Def. unit	Unit ring
+34.0 dBm to +99.9 dBm	Ref. power for max. power level	39	dBm	–

Description of command	FW vers.
This command defines the MS output power range where the relative limit lines are given by linear interpolation between a minimum and a maximum relative power level. See command `CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetical]:UPPer<nr>` and detailed explanation in chapter 4. The value range applies with the additional condition `<Minimum> ≤ <Maximum> – 1dB.`	V1.25

CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:MODE[:UPPer] *<Mode>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:MODE[:UPPer] *<Mode>* Limits on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on limit lines Switch off limit lines	ON	–	

Description of command	FW vers.
This command switches all limit lines for the spectrum due to modulation measurement on or off.	V1.20

CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:DEFault *<Enable>*
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem are set to default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			

Description of command	FW vers.
If used as a setting command with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* causes an error message). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	2.0

Subsystem SUBarrays:SPECtrum:MODulation

The subsystem *SUBarrays:SPECtrum:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MODulation[:GMSK]
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–1.8 MHz to 1.8 MHz,	Frequency of first point in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 23	Number of samples in current range	23	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:MODulation` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:MODulation:LIMit:LINE<nr>`). If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>.	2.0

For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *spectrum due to modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:MODulation

The subsystem *SPECtrum:MODulation* measures and returns the frequency spectum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:MODulation[:GMSK]? Scalar Results:
READ[:SCALar]:SPECtrum:MODulation:EPSK? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MODulation[:GMSK]?
FETCh[:SCALar]:SPECtrum:MODulation:EPSK? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MODulation[:GMSK]?
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK? Read measurement results (synchronized)

<table>
<tr><th><i>Returned values</i></th><th>Value range</th><th>Def. value</th><th>Def. unit</th><th>Unit ring</th></tr>
<tr><td>Reference Power,</td><td>–100.0 dBm to +100.0 dBm</td><td>NAN</td><td>dBm</td><td></td></tr>
<tr><td>Matching</td><td>INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF</td><td>INV</td><td>–</td><td></td></tr>
</table>

Description of command	FW vers.
These commands are always queries. - `READ` starts a single shot measurement and returns the results. - `FETCh` outputs the current results regardless of the measurement state. - `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results. For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.	V1.20

The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

READ:ARRay:SPECtrum:MODulation[:GMSK]? Spectrum Results
READ:ARRay:SPECtrum:MODulation:EPSK? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:MODulation[:GMSK]?
FETCh:ARRay:SPECtrum:MODulation:EPSK? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:MODulation[:GMSK]?
SAMPle:ARRay:SPECtrum:MODulation:EPSK? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB,	Power at measurement point 1	NAN	dB	
...,	...	...	...	
–100.0 dB to + 20.0 dB	Power at measurement point *n*	NAN	dB	

Description of command	FW vers.
These commands are always queries. They return the off-carrier power due to modulation at all measurement points.	V1.20

READ:SUBarrays:SPECtrum:MODulation[:GMSK]? Subarray Results
READ:SUBarrays:SPECtrum:MODulation:EPSK?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:SPECtrum:MODulation[:GMSK]?
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:SPECtrum:MODulation[:GMSK]?
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	Power[1], 1st value for power	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	Power[x], xth value for power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the off-carrier power due to modulation in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MODulation` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum:MODulation` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.	2.0

SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* measures the off-carrier power due to the bursty nature of the GSM signal. The subsystem corresponds to the measurement menu *Spectrum,* application *due to Switching,* and the associated configuration popups.

Control of Measurement – Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* controls the spectrum due to switching measurement.

INITiate:SPECtrum:SWITching[:GMSK] **INITiate:SPECtrum:SWITching:EPSK**	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:SWITching[:GMSK] **ABORt:SPECtrum:SWITching:EPSK**	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:SWITching[:GMSK] **STOP:SPECtrum:SWITching:EPSK**	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:SWITching[:GMSK] **CONTinue:SPECtrum:SWITching:EPSK**	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V1.20

CONFigure:SPECtrum:SWITching[:GMSK]:EREPorting <*Mode*>
CONFigure:SPECtrum:SWITching:EPSK:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).	V1.20

FETCh:SPECtrum:SWITching[:GMSK]:STATus?
FETCh:SPECtrum:SWITching:EPSK:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	V1.20

Subsystem SPECTrum:SWITching:CONTrol

The subsystem *SPECtrum:SWITching:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control tab* in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol *<Mode>,<Statistics>*
CONFigure:SPECtrum:SWITching:EPSK:CONTrol *<Mode>,<Statistics>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	10	–	

Description of command	FW vers.
This command restricts the type of measured values and determines the number of bursts within a statistics cycle.	V1.20

CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:REPetition
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCondition>, <Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot*	V1.20

DISPlay:SPECtrum:SWITching[:GMSK]:CONTrol:GRID *<Enable>*
DISPlay:SPECtrum:SWITching:EPSK:CONTrol:GRID *<Enable>* Grid

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on grid lines Switch off grid lines	ON	–	

Description of command	FW vers.
This command switches the grid lines in the test diagrams on or off.	V1.20

CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:MPOint<nr>:ENABle <Enable>
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:MPOint<nr>:ENABle <Enable>

Enable/Disable Measurement Points

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on measurement point <nr>	ON	–	
OFF	Switch off measurement point <nr>			

Description of command	FW vers.
This command switches the measurement at the individual frequency points no. 1 to 4 (numbered by the numeric suffix <nr>) on or off.	V1.20

CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:DEFault *<Enable>*
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:DEFault *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem correspond to their default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			

Description of command	FW vers.
If used as a setting command with the parameter *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* causes an error message). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	2.0

Test Configuration

The commands of the following subsystems configure the spectrum due to switching. They correspond to the *due to Switching* sections in the *Spectrum Configuration* menu.

Subsystem SPECTrum:SWITching:LIMit:LINE

The subsystem *SPECtrum:SWITching:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the spectrum due to switching measurement. The subsystem corresponds to the *due to Switching* sections in the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

Limits

CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle
<Enable>
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>
<Power level>, <Limit at 0.4 MHz>, <Limit at 0.6 MHz>, <Limit at 1.2 MHz>, <Limit at 1.8 MHz>,<Enable>

Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to10	Power level no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Defined section on/off	ON
<Power level>,	–100 dBm to 30 dBm	MS output power for power level <nr>	See below
<Limit at 0.4 MHz>,	–100 dBm to 30 dBm	Limit for the measurement point at: 0.4 MHz from carrier frequency	See below
<Limit at 0.6 MHz>,	–100 dBm to 30 dBm	0.6 MHz from carrier frequency	
<Limit at 1.2 MHz>,	–100 dBm to 30 dBm	1.2 MHz from carrier frequency	
<Limit at 1.8 MHzl>,	–100 dBm to 30 dBm	1.8 MHz from carrier frequency	
<Enable>	ON | OFF| DEFault	Enable or disable limit check for power level <nr>	See below

Description of command	FW vers.
These commands activate and define limit lines for the spectrum due to switching measurement.	V1.20

The value range for the individual power levels <nr> at the same frequency applies with the additional conditions `<PowerLevel(n+1)> ≤ <PowerLevel(n)> - 1 dB` and `|<PowerLevel(n+1)> - <PowerLevel(n)>| ≤ 100 dB.`

The limits are defined depending on 10 definable MS output power levels numbered by the numeric suffix <nr> and four fixed frequency offsets from the carrier. The first parameter defines the power of level no. <nr>. For the 1st and the 10th level, limit values are entered: The levels then comprise all powers greater than or less than the specified limits.

For switching on or off one measurement point over all power levels, please use the command

```
CONFigure:SPECtrum:SWITching:LIMit:LINE:ENABle[:UPPer]
```

To switch on or off the limit check altogether please use the command

```
CONFigure:SPECtrum:SWITching:LIMit:LINE:MODE[:UPPer] <Mode>
```

Default values for GSM400/850/900 (both modulation schemes):

Level <nr>	Level / [dBm]	0.4 MHz / [dBc]	0.6 MHz / [dBc]	1.2 MHz / [dBc]	1.8 MHz / [dBc]
1	≥ 39.0	–13.0	–21.0	–21.0	–24.0
2	37.0	–15.0	–21.0	–21.0	–24.0
3	35.0	–17.0	–21.0	–21.0	–24.0
4	33.0	–19.0	–21.0	–21.0	–24.0
5	31.0	–21.0	–23.0	–23.0	–26.0
6	29.0	–23.0	–25.0	–25.0	–28.0
7	27.0	–23.0	–26.0	–27.0	–30.0
8	25.0	–23.0	–26.0	–29.0	–32.0
9	23.0	–23.0	–26.0	–31.0	–34.0
10	≤ 21.0	–23.0	–26.0	–32.0	–36.0

Default values for GSM1800 (both modulation schemes):

Level <nr>	Level / [dBm]	0.4 MHz / [dBc]	0.6 MHz / [dBc]	1.2 MHz / [dBc]	1.8 MHz / [dBc]
1	≥ 36.0	–16.0	–21.0	–21.0	–24.0
2	34.0	–18.0	–21.0	–21.0	–24.0
3	32.0	–20.0	–22.0	–22.0	–25.0
4	30.0	–22.0	–24.0	–24.0	–27.0
5	28.0	–23.0	–25.0	–26.0	–29.0
6	26.0	–23.0	–26.0	–28.0	–31.0
7	24.0	–23.0	–26.0	–30.0	–33.0
8	22.0	–23.0	–26.0	–31.0	–35.0
9	≤ 20.0	–23.0	–26.0	–32.0	–36.0

Default values for GSM1900 (both modulation schemes):

Level <nr>	Level / [dBm]	0.4 MHz / [dBc]	0.6 MHz / [dBc]	1.2 MHz / [dBc]	1.8 MHz / [dBc]
1	≥ 33.0	–19.0	–22.0	–22.0	–25.0
2	32.0	–20.0	–22.0	–22.0	–25.0
3	30.0	–22.0	–24.0	–24.0	–27.0
4	28.0	–23.0	–25.0	–26.0	–29.0
5	26.0	–23.0	–26.0	–28.0	–31.0
6	24.0	–23.0	–26.0	–30.0	–33.0
7	22.0	–23.0	–26.0	–31.0	–35.0
8	≤ 20.0	–23.0	–26.0	–32.0	–36.0

CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:MODE[:UPPer] *<Mode>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:MODE[:UPPer] *<Mode>* Limit Check on/off

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on limit lines	ON	–	
OFF	Switch off limit lines			

Description of command	FW vers.
This command switches all limits for the spectrum due to switching measurement on or off.	V1.20

CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:DEFault *<Enable>*
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:DEFault *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem are set to default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			

Description of command	FW vers.
If used as a setting command with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* causes an error message). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	2.0

Subsystem SUBarrays:SPECtrum:SWITching

The subsystem *SUBarrays:SPECtrum:SWITching* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:SWITching[:GMSK]
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum |	Return maximum value in every range			
IVAL,	Return single interpolated value at <Start>			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–1.8 MHz to 1.8 MHz,	Start frequency in current range	–1.8	MHz	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 9	Number of samples in current range	9	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays..`, `FETCh:SUBarrays..`, and `SAMPle:SUBarrays:SPECtrum:SWITching` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located at fixed frequencies (see command `CONFigure:SPECtrum:SWITching:LIMit:LINE<nr>`). If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>.	2.0

For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *spectrum due to switching* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to switching measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum:SWITching

The subsystem *SPECtrum:SWITching* measures and returns the frequency spectum (due to switching) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum:SWITching[:GMSK]? Scalar Results
READ[:SCALar]:SPECtrum:SWITching:EPSK? Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:SWITching[:GMSK]?
FETCh[:SCALar]:SPECtrum:SWITching:EPSK? Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:SWITching[:GMSK]?
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
Reference Power,	–100.0 dBm to +100.0 dBm	NAN	dBm	
Matching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command	FW vers.
These commands are always queries. They start a measurement and return the results. For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual. The reference power is the absolute carrier power measured as specified in the GSM standard. The following messages may be output for the value *Matching*:	V1.20

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

READ:ARRay:SPECtrum:SWITching[:GMSK]? Spectrum Results
READ:ARRay:SPECtrum:SWITching:EPSK? Start single shot measurement and return results
FETCh:ARRay:SPECtrum:SWITching[:GMSK]?
FETCh:ARRay:SPECtrum:SWITching:EPSK? Read measurement results (unsynchronized)
SAMPle:ARRay:SPECtrum:SWITching[:GMSK]?
SAMPle:ARRay:SPECtrum:SWITching:EPSK? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 100.0 dB,	Power at measurement point 1	NAN	dBm	
...,	...	...	...	
–100.0 dB to + 100.0 dB	Power at measurement point *n*	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They return the off-carrier power due to switching at all measurement points.	V1.20

READ:SUBarrays:SPECtrum:SWITching[:GMSK]? **READ:SUBarrays:SPECtrum:SWITching:EPSK?**	Subarray Results Start meas. and return results			*RUN*
FETCh:SUBarrays:SPECtrum:SWITching[:GMSK]? **FETCh:SUBarrays:SPECtrum:SWITching:EPSK?**	Read meas. results (unsynchronized)			*RUN*
SAMPle:SUBarrays:SPECtrum:SWITching[:GMSK]? **SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?**	Read results (synchronized)			*RUN*
Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 100.0 dB	Power[1], 1st value for power	NAN	dB	
...	...	...	...	
–100.0 dB to + 100.0 dB	Power[x], xth value for power	NAN	dB	
Description of command				FW vers.
These commands are always queries. They output the off-carrier power due to switching in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:SWITching` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum:SWITching` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.				2.0

Symbolic Status Event Register Evaluation

The following commands are used to retrieve the events reported in function groups *GSM400/850/900/1800/1900-MS Non Signalling* and *Signalling*; see section *Symbolic Status Event Register Evaluation* in Chapter 5 of the CMU operating manual.

STATus:OPERation:SYMBolic:ENABle <Event>{,<Event>} Symbolic status evaluation

Parameter list	Parameter description	Def. Value[2]	Default Unit	Unit Ring
<Event>{,<Event>} | **NONE**	List of symbols for events to be reported No event reported	NONE	–	

Command description	FW vers.
This command enables event reporting for one or several events in the current *GSMxxx-MS Non Signalling* function group, i.e. it sets the corresponding bits in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:ENABle` register (`<nr> = 1 | 2, <nr_event>` denotes the current function group) and in all sum registers up to the status byte. The events and the corresponding symbols for the function group are listed in Chapter 5 (see section *Status Registers).* The symbols may be entered in arbitrary order.	V3.05

STATus:OPERation:SYMBolic[:EVENt]? Symbolic status evaluation

Response	Parameter description	Def. Value[3]	Default Unit	Unit Ring
NONE | **<Event>{,<Event>}**	No event in the *RF* function group List of reported events	NONE	–	

Command description	FW vers.
This command is always a query. It lists the events reported in the current *GSMxxx-MS Non Signalling* function group and deletes these events in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:EVENt` register as well as in all sum registers.	V3.05

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[2] The default values quoted in this command are achieved after a `STATus:PRESet` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

[3] The default values quoted in this command are achieved after a `*CLS` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

Measurement Groups (Signalling)

The measurement groups in this section are either provided in *Signalling* mode only or implemented with major differences in the two test modes.

POWer[:NORMal]

The subsystem *POWer[:NORMal]* measures the MS transmitter output power versus time for normal bursts. The subsystem corresponds to the measurement menu *Power*, application *P/t Normal...*, and the associated popup menu *Power Configuration.*

Note1: Measurements and signalling states

To perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, for the measurements reported in the following sections, the Call Established (CEST) signalling state must be reached before any of the commands retrieving test results (`READ...?`, `FETCh...?`, `SAMPle...?`, or `CALCulate...LIMit?`) can be used. Test configurations, however, can be defined any time.

Note2: GMSK and 8PSK modulation

The keywords `[:GMSK]` and `:EPSK` in the remote control commands denote GMSK and 8PSK modulation, respectively. The `:EPSK` commands in Signalling measurements are included in firmware versions V3.05 and higher. The firmware version numbers quoted in the command tables refer to GMSK modulation.

Control of Measurement – Subsystem Power[:NORMal]

The subsystem *POWer[:NORMal]* controls the normal burst power measurement.

INITiate:POWer[:NORMal][:GMSK] **INITiate:POWer[:NORMal]:EPSK**	Start new measurement	RUN
ABORt:POWer[:NORMal][:GMSK] **ABORt:POWer[:NORMal]:EPSK**	Abort running measurement and switch off	OFF
STOP:POWer[:NORMal][:GMSK] **STOP:POWer[:NORMal]:EPSK**	Stop measurement after current stat. cycle	STOP
CONTinue:POWer[:NORMal][:GMSK] **CONTinue:POWer[:NORMal]:EPSK**	Next measurement step (only stepping mode)	RUN
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		≥1.15

CONFigure:POWer[:NORMal][:GMSK]:EREPorting *<Mode>*
CONFigure:POWer[:NORMal]:EPSK:EREPorting *<Mode>*

Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).	≥1.15

FETCh:POWer[:NORMal][:GMSK]:STATus?
FETCh:POWer[:NORMal]:EPSK:STATus?

Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	–

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	≥1.15

CONFigure:POWer[:NORMal][:GMSK]:TIME:BOFFset *<Offset>*
CONFigure:POWer[:NORMal]:EPSK:TIME:BOFFset *<Offset>*

Bit Offset

<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 to +4.00	Number of bits	0	bit	

Description of command	FW vers.
This command defines an offset time in ¼ bit units by which the burst is shifted relative to the time axis and the tolerance template.	2.15

CONFigure:POWer[:NORMal][:GMSK]:FILTer *<Filter>*
CONFigure:POWer[:NORMal]:EPSK:FILTer *<Filter>*

Filter

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
G500 |	500 kHz Gaussian filter	G500 for GMSK modulation	–	–
B600	600 kHz bandpass filter	B600 for 8PSK modulation		

Description of command	FW vers.
This command selects the measurement filter for the *P/t* measurement. The default filter setting differs for the two modulation schemes.	V3.05

Test Configuration

The commands of the following subsystems configure the power measurement. They correspond to the sections in the *Power Configuration* popup menu that are related to the normal burst power measurement. For a detailed explanation of the power tolerance template defined in the GSM standard see chapter 4.

Subsystem POWer[:NORMal]:CONTrol

The subsystem *POWer[:NORMal]:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* tab of the popup menu *Power Configuration.*

CONFigure:POWer[:NORMal][:GMSK]:CONTrol *<Mode>, <Statistics>* Scope of Measurement
CONFigure:POWer[:NORMal]:EPSK:CONTrol *<Mode>, <Statistics>*

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar |	Scalar values only (incl. ramp matching)	ARRay	–	–
ARRay,	Scalar measured values and arrays			
<Statistics>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
1 to 1000 |	Number of bursts per statistics cycle	100	–	–
OFF	Statistics off (equivalent to 1)			

Description of command	FW vers.
This command restricts the type of measured values to accelerate the measurement and determines the number of bursts within a statistics cycle.	≥1.15

CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition Test cycles
CONFigure:POWer[:NORMal]:EPSK:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCondition>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.	≥1.15

DISPlay:POWer[:NORMal][:GMSK]:CONTrol:GRID *<Enable>* **DISPlay:POWer[:NORMal]:EPSK:CONTrol:GRID *<Enable>***				Grid
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on grid lines Switch off grid lines	ON	–	–
Description of command				FW vers.
This command switches the grid lines in the test diagrams on or off.				≥1.15

CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode *<Mode>*				Ref. Power Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CURRent | **AVERage |** **DCOMpens**	Ref. Power calculated from current burst Ref. Power calculated from average curve Data compensated/corrected reference power	CURR	–	
Description of command				FW vers.
This command determines how the reference power (0-dB line in the *P/t Norm. 8PSK* test diagram) for 8PSK-modulated signals is calculated.				2.15

CONFigure:POWer[:NORMal][:GMSK]:CONTrol:DEFault <Enable> **CONFigure:POWer[:NORMal]:EPSK:CONTrol:DEFault <Enable>**				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters are not set to default	ON	–	–
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				2.00

Subsystem POWer[:NORMal]...:LIMit:LINE

The subsystem *POWer[:NORMal]...:LIMit:LINE* defines the limit lines and thus the tolerance values for the normal burst power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>[:STATic]:ENABle ***<Enable>***
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic]:ENABle ***<Enable>***
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<nr>[:STATic]
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic] Upper Limit Line

Parameters for query: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <StartVisibility>, <EndVisibility>***

for setting: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>***

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Defined section on/off	See below
<StartTime>,	–10 bit to +156 ¾ bit | OFF	Start point of time	
<EndTime>,	–10 bit to +156 ¾ bit | OFF,	End point of time	
<StartRelLevel>,	–100 dB to 20 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 20 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 50 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 50.0 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	
<StartVisib.>			
<EndVisib>			

Description of command	FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined section by section; the suffix <nr> numbers the various ranges of the limit lines.	≥1.15

For GMSK modulation (keyword `[:GMSK]`), 8 areas are defined in the default setting, another 8 areas can be activated if required. The default settings are given in the table below:

	for Enable		forTable					
Suffix	Enable	Start Time	Stop Time	Start rel.Level	Stop rel.Level	Start abs.Level	Stop abs.Level	Visibility
1	ON	–10.0 bit	–7 ¼ bit	–59.0[1] dB	–59.02 dB	–36.0[2] dBm	–36.0[2] dBm	ON
2	ON	–7 ¼ bit	–4 ½ bit	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
3	ON	–4 ½ bit	–2 ¼ bit	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2 ¼ bit	+½ bit	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	½ bit	150 ¼ bit	+1.0 dB	+1.0 dB	OFF	OFF	ON
6	ON	150 ¼ bit	152 ½ bit	–6.0 dB	–6.0 dB	OFF	OFF	ON
7	ON	152 ½ bit	155 ¼ bit	–30.0 dB	–30.0 dB	–17.0[3] dBm	–17.0[3] dBm	ON
8	ON	155 ¼ bit	156 ¾ bit	–59.0[1] dB	–59.0[1] dB	–36.0[2] dBm	–36.0[2] dBm	ON
9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The setting *Visibility* = *Off* implies that the corresponding range, including the limit check, is switched off. *Enable* = *Off* switches off the entire limit check.

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[1] GSM400/850/900. The value for GSM1800 and GSM1900 is –48.0 dB.

[2] GSM400/850/900. The value for GSM1800 and GSM1900 is –48.0 dBm.

[3] GSM400/850/900. The value for GSM1800 and GSM1900 is –20.0 dBm.

The default settings for 8MSK modulation (EDGE channels, keyword `:EPSK`) are given in the table below:

	for Enable		forTable					
		Start	Stop	Start	Stop	Start	Stop	
Suffix	Enable	Time	Time	rel.Level	rel.Level	abs.Level	abs.Level	Visibility
1	ON	–10.0 symb	–7 ¼ symb	–59.0^{1} dB	–59.0^{1} dB	–36.0^{2} dBm	–36.0^{2} dBm	ON
2	ON	–7 ¼ symb	–4 ½ symb	–30.0 dB	–30.0 dB	–17.0^{3} dBm	–17.0^{3} dBm	ON
3	ON	–4 ½ symb	–2 ¼ symb	–6.0 dB	–6.0 dB	OFF	OFF	ON
4	ON	–2 ¼ symb	+½ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
5	ON	½ symb	1 ½ symb	+2.4 dB	+2.4 dB	OFF	OFF	ON
6	ON	1 ½ symb	146 ½ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
7	ON	146 ½ symb	147 ½ symb	+2.4 dB	+2.4 dB	OFF	OFF	ON
8	ON	147 ½ symb	150 ¼ symb	+4.0 dB	+4.0 dB	OFF	OFF	ON
9	ON	150 ¼ symb	152 ½ symb	–6.0 dB	–6.0 dB	OFF	OFF	ON
10	ON	152 ½ symb	155 ¼ symb	–30.0 dB	–30.0 dB	–17.0^{3} dBm	–17.0^{3} dBm	ON
11	ON	155 ¼ symb	156 ¾ symb	–59.0^{1} dB	–59.0^{1} dB	–36.0^{2} dBm	–36.0^{2} dBm	ON
12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>[:STATic]:ENABle ***<Enable>***
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]:ENABle ***<Enable>***

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<nr>[:STATic]
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic] Lower Limit Line

Parameters for query: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <StartVisibility>, <EndVisibility>***

for setting: ***<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>***

Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Definition section on/off	See below
<StartTime>,	–10 bit to +156 ¾ bit | OFF	Start point of time	
<EndTime>,	–10 bit to +156 ¾ bit | OFF,	End point of time	
<StartRelLevel>,	–100 dB to 20 dB | OFF,	Start point of level (relative)	
<EndRelLevel>,	–100 dB to 20 dB | OFF,	End point of level (relative)	
<StartAbsLevel>,	–90 dBm to 50 dBm | OFF,	Start point of level (absolute)	
<EndAbsLevel>,	–90 dBm to 50 dBm | OFF,	End point of level (absolute)	
<Visibility>	ON | OFF	Range of limit lines on/off	
<StartVisib.>			
<EndVisib>			

Description of command	FW vers.
These commands activate and define lower limit lines for normal bursts. The limit lines are defined section by section; the suffix <nr> numbers the different ranges of limit lines.	≥1.15

Only 1 area is defined in the default setting, another 15 areas can be activated if required. The default settings for GMSK modulation (keyword `[:GMSK]`) are shown in the table below:

	for Enable		for Table					
	Start	Stop	Start	Stop	Start	Stop		
Suffix	Enable	Time	Time	rel.Level	rel.Level	abs.Level	abs.Level	Visibility
1	ON	–10.0 bit	½ bit	OFF	OFF	OFF	OFF	OFF
2	ON	½ bit	147 ½ bit	–1.0 dB	–1.0 dB	OFF	OFF	ON
3	ON	147 ½ bit	156 ¾ bit	OFF	OFF	OFF	OFF	ON
4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The default settings for 8MSK modulation (EDGE channels, keyword `:EPSK`) are given in the table below:

Suffix	for Enable Start Enable	Stop Time	for Table Start Time	Stop rel.Level	Start rel.Level	Stop abs.Level	abs.Level	Visibility
1	ON	–10.0 symb	½ symb	OFF	OFF	OFF	OFF	OFF
2	ON	½ symb	1 symb	–2.0 dB	–2.0 dB	OFF	OFF	ON
3	ON	1 symb	1 ½ symb	0.0 dB	0.0 dB	OFF	OFF	ON
4	ON	1 ½ symb	146 ½ symb	–15.0 dB	–15.0 dB	OFF	OFF	ON
5	ON	146 ½ symb	147 symb	0.0 dB	0.0 dB	OFF	OFF	ON
6	ON	147 symb	147 ½ symb	–2.0 dB	–2.0 dB	OFF	OFF	ON
7	ON	147 ½ symb	156 ¾ symb	OFF	OFF	OFF	OFF	OFF
8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
...								
16	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>:ENABle
<Enable>

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:DYNamic<RangeNr>
<fromTPCL>, <toTPCL>, <Correction>, <Enable> Dynamic Correction

<fromPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | MAX | OFF	First PCL for which area <AreaNr> is changed	See table below	PCL	
<toPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | MAX | OFF	Last PCL for which area <AreaNr> is changed.	See table below	PCL	
<Correction>	Description of parameters	Def. value	Def. unit	Unit ring
-10 dB to +10 dB | OFF	Correction value (relative) for the limit line in area <AreaNr> applied for all PCLs between <fromPCL> and <toPCL> (including)	See table below	dB	
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable dynamic correction in the current limit line area and PCL range	See table below	–	–

Description of command FW vers.

These command activates and defines dynamic correction of the upper limit line of area <AreaNr> (<AreaNr> = 1 to 16) depending on the PCL range <RangeNr> (<RangeNr> = 1 to 10 for each area). *MAX* denotes the maximum output power (smallest PCL) of the mobile phone under test.

In the areas no. 3 and 6, the following ranges are defined:

Range	**from TPCL**	**to TPCL**	**Correction**	**Enable**
1	16	16	+2.0 dB	ON
2	17	17	+4.0 dB	ON
3	18	19	+5.0 dB	ON
4	OFF	OFF	0.0 dB	OFF
5	OFF	OFF	0.0 dB	OFF
6	OFF	OFF	0.0 dB	OFF
7	OFF	OFF	0.0 dB	OFF
8	OFF	OFF	0.0 dB	OFF
9	OFF	OFF	0.0 dB	OFF
10	OFF	OFF	0.0 dB	OFF

In the remaining areas, the dynamic limit line correction is disabled in all ranges.

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer<AreaNr>:ALL:DYNamic:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<AreaNr>:ALL:DYNamic:ENABle
<Enable>

Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction on or off	ON	–	–

Description of command	FW vers.
This command switches the dynamic correction of the upper limit area <nr> for all ten PCL ranges on or off.	2.00

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:UPPer:ALL:DYNamic:ENABle *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer:ALL:DYNamic:ENABle *<Enable>*

Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dyn. correction for the whole template on or off	ON	–	–

Description of command	FW vers.
This command switches the dynamic correction of the upper limit line in all areas and for all PCL ranges on or off. The query returns 160 Boolean values corresponding to the limit check in PCL ranges 1 to 10 (inner loop) in each of the areas 1 to 16 (outer loop).	2.00

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<AreaNr>:DYNamic<RangeNr>
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:DYNamic<RangeNr>

<fromPCL>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31 | MAX | OFF	First PCL for which area <AreaNr> is changed	OFF	PCL	
<toPCL>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
0 to 31 | MAX | OFF	Last PCL for which area <AreaNr> is changed.	OFF	PCL	
<Correction>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
-10 dB to +10 dB | OFF	Correction value (relative) for the limit line in area <AreaNr> applied for all PCLs between <fromPCL> and <toPCL> (including)	OFF	dB	
<Enable>	**Description of parameters**	**Def. value**	**Def. unit**	**Unit ring**
ON | OFF	Enable or disable dynamic correction in the current limit line area and PCL range	OFF	–	–

Description of command	FW vers.
These command activates and defines dynamic correction of the lower limit line of area <AreaNr> depending on the PCL range <RangeNr>. *MAX* denotes the maximum output power (smallest PCL) of the mobile phone under test. By default, the dynamic limit line correction is disabled in all ranges and areas.	2.00

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle
<Enable> Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dynamic correction on or off	OFF	–	–

Description of command	FW vers.
This command switches the dynamic correction of the lower limit area <nr> for all ten PCL ranges on or off. The query returns 160 Boolean values corresponding to the limit check in PCL ranges 1 to 10 (inner loop) in each of the areas 1 to 16 (outer loop).	2.00

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer:ALL:DYNamic:ENABle *<Enable>*
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer:ALL:DYNamic:ENABle *<Enable>*
Dynamic Correction on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch dyn. correction for the whole template on or off	OFF	–	–

Description of command	FW vers.
This command switches the dynamic correction of the lower limit line in all areas and for all PCL ranges on or off.	2.00

CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:DEFault *<Enable>* Default Settings
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:DEFault *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	–
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	≥1.15

Subsystem POWer[:NORMal]...:LIMIt:ABPower

The subsystem *POWer[:NORMal]...:LIMit:ABPower* defines the limit values for the average normal burst power. The subsystem corresponds to the tab *Limits* in the popup menu *Power Configuration*.

CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr> Average Burst Power
<StartPCL>, <StopPCL>, <LowerLimit>, <UpperLimit>
CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>:ENABle *<Enable>*

Parameter	Value range	Description of parameters	Def. value
<Enable>	**ON | OFF**	Definition section on/off	see below
<StartPCL>,	**0 to 31 | MAX**	Start value for PCL	see below
<StopPCL>,	**0 to 31 | MAX**	End value for PCL	
<LowerLimit>,	**–10.0 dB to 0.0 dB**	Lower level limit	
<UpperLimit>	**0.0 dB to +10.0 dB**	Upper level limit	

Description of command	FW vers.
These commands determine the tolerances for ranges of power control levels (PCLs). <nr> is the number of the group ($< nr > \in \{1,...,10\}$) The setting *MAX* is synonymous with the highest PCL of the mobile, depending on its power class.	≥1.15

4 level ranges are defined in the default setting, another 6 ranges can be activated if required. The default settings for GSM 900/1800/1900 will be given in the following table:

	For Enable	for table			
Suffix	Enable	StartPCL	StopPCL	LowerLimit	UpperLimit
1	ON	MAX	MAX	–2.0 dB	+2.0 dB
2	ON	0	2/8/8	–2.0/–3/–3 dB	+2.0/3.0/3.0 dB
3	ON	3/9/9	15/13/13	–3.0/–4/–4 dB	+3.0/4.0/4.0 dB
4	ON	16/14/14	31/28/29	–5.0 dB	+5.0 dB
5	OFF/ON/ON	OFF/29/30	OFF/29/31	OFF/–2.0/–2.0 dB	OFF/5.0/2.0 dB
6	OFF/ON/OFF	OFF/30/OFF	OFF/31/OFF	OFF/–3.0 dB/OFF	OFF/2.0 dB/OFF
10	OFF	OFF	OFF	OFF	OFF

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer[:NORMal][:GMSK]
CONFigure:SUBarrays:POWer[:NORMal]:EPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum |	Return maximum value in every range			
IVAL,	Return single interpolated value at <Start>			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–10 bit to 156 ¾ bit,	Start time in current range	–10	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 668	Number of samples in current range	668	–	

Description of command — FW vers. 2.00

This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>.

For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located between two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation.

The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values

The commands of the following subsystems determine and return the results of the normal burst power measurement. They correspond to the graphical menu *Power* with its various display elements.

Subsystem POWer[:NORMal]...

The subsystem *POWer[:NORMal]...* contains the commands for measurement and output of the normal burst power and its comparison with tolerance values. The subsystem corresponds to the graphical measurement menu *Power.*

READ[:SCALar]:POWer[:NORMal][:GMSK]?	Scalar results:
READ[:SCALar]:POWer[:NORMal]:EPSK?	Start single shot measurement and return results
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?	
FETCh[:SCALar]:POWer[:NORMal]:EPSK?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?	
SAMPle[:SCALar]:POWer[:NORMal]:EPSK?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PowerControlLevel,	0 to 32 (dep. on network, see chap. 4)	NAN	PCL	
TimingAdvError,	-100.0 bit to +100.0 bit	NAN	bit	
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
AvgBurstPwAvg	–137 dBm to +53 dBm	NAN	dBm	

Description of command	FW vers.
These commands are always queries.	≥1.15

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The results are:

Average burst power (current burst)
Peak burst power (current burst)
Power control level
Timing advance error
Burst out of tolerance
Burst template matching
Average burst power of average trace

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

CALCulate:POWer[:NORMal][:GMSK]:LIMit:MATChing?
CALCulate:POWer[:NORMal]:EPSK:LIMit:MATChing?

Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	–
PeakBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
TimingAdvError,	OK (no limit check)	INV	–	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	—	
AvgBurstPwAvg	NMAU | NMAL | INV | OK	INV		

Description of command — FW vers. ≥1.15

This command is always a query. It indicates whether and in which way the tolerances for the scalar measured values (see command above) have been exceeded. The following messages may be output for the values *AvgBurstPowerCurr*, *PeakBurstPowerCurr* and *AvgBurstPowerAvg*:

OK	Tolerance value matched	*OK.*
NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measured value invalid	*invalid*

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

READ:ARRay:POWer[:NORMal][:GMSK][:CURRent]?
READ:ARRay:POWer[:NORMal]:EPSK[:CURRent]? Burst Power
READ:ARRay:POWer[:NORMal][:GMSK]:AVERage?
READ:ARRay:POWer[:NORMal]:EPSK:AVERage?
READ:ARRay:POWer[:NORMal][:GMSK]:MAXimum?
READ:ARRay:POWer[:NORMal]:EPSK:MAXimum?
READ:ARRay:POWer[:NORMal][:GMSK]:MINimum?
READ:ARRay:POWer[:NORMal]:EPSK:MINimum?
Start single shot measurement and return results *RUN*
FETCh:ARRay:POWer[:NORMal][:GMSK][:CURRent]?
FETCh:ARRay:POWer[:NORMal]:EPSK[:CURRent]?
FETCh:ARRay:POWer[:NORMal][:GMSK]:AVERage?
FETCh:ARRay:POWer[:NORMal]:EPSK:AVERage?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MAXimum?
FETCh:ARRay:POWer[:NORMal]:EPSK:MAXimum?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MINimum?
FETCh:ARRay:POWer[:NORMal]:EPSK:MINimum?
Read meas. results (unsynchronized) *RUN*
SAMPle:ARRay:POWer[:NORMal][:GMSK][:CURRent]?
SAMPle:ARRay:POWer[:NORMal]:EPSK[:CURRent]?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:AVERage?
SAMPle:ARRay:POWer[:NORMal]:EPSK:AVERage?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MAXimum?
SAMPle:ARRay:POWer[:NORMal]:EPSK:MAXimum?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MINimum?
SAMPle:ARRay:POWer[:NORMal]:EPSK:MINimum?
Read results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	FG Power Level
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the different power values of the bursts in a fixed ¼-bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to 156 ¾ bit.	≥1.15

READ:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]? Subarray Results
READ:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
READ:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
READ:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
READ:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
READ:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Start single shot measurement and return results *RUN*

FETCh:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?
FETCh:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:AVERage?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MINimum?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.00

CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MINimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MINimum?
Burst Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
Matching	MATC | NMAT | INV | NTSC | OUT	INV	–	–

Description of command	FW vers.
This command is always a query. It indicates whether and in which way tolerances for the burst power (see command above) have been exceeded. The following messages may be output for the value *Matching*: MATC *matching* NMAT *not matching* INV *invalid* NTSC *no training sequence code* OUT *out of tolerance*	≥1.15

CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing[:CURRent]?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:AVERage?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MAXimum?
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MINimum?
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MINimum?
Range Violation

Returned value	Description of parameters	Def. value	Def. unit	Unit ring
32 bit value,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	–
32 bit value	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	–

Description of command	FW vers.
This command is always a query. If a bit is set in the two returned values the corresponding section of the limit lines is exceeded.	1.20

POWer:ABURst

The subsystem *POWer:ABURst* measures the MS output carrier power versus time for access bursts. The subsystem corresponds to the measurement menu *Power,* application *P/t Access...*, and the associated popup menu *Power Configuration*. It contains all commands for measurement control and for the output of measurement results. The limit lines, however, are taken from the `POWer[:NBURst]` subsystem and adapted to the shortened access burst:

- The central part (area no. 5 of the upper limit line and area no. 3 of the lower limit line) is 60 bits shorter.
- The position of areas around the falling edge is adapted to the shortened central part: Areas no. 6 to 8 of the upper limit line and area no. 3 of the lower limit line are shifted by –60 bit.

Note that access burst measurements are always made on a single burst, so no `:CONTrol` subsystem and no display modes `[:CURRent], :AVERage, MINimum, :MAXimum` are needed.

Note:

> To perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, for the measurements reported in the following sections, the *Call Established (CEST)* signalling state must be reached before any of the commands retrieving test results *(`READ...?`, `FETCh...?`, `SAMPle...?`,* or *`CALCulate...LIMit?`)* can be used. Test configurations, however, can be defined any time.

Control of Measurement – Subsystem POWer:ABURst

The subsystem *POWer:ABURst* controls the access burst power measurement.

INITiate:POWer:ABURst[:GMSK]	Start new measurement	*RUN*
ABORt:POWer:ABURst[:GMSK]	Abort measurement and switch off	*OFF*
STOP:POWer:ABURst[:GMSK]	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:ABURst[:GMSK]	Next meas. step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V3.0

CONFigure:POWer:ABURst[:GMSK]:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V3.0

FETCh:POWer:ABURst[:GMSK]:STATus?	Measurement Status			
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the OFF state (*RST or ABORt)	OFF	–	–
RUN |	Running (after INITiate, CONTinue or READ)			
STOP |	Stopped (STOP)			
ERR |	OFF (could not be started)			
STEP |	Stepping mode (<stepmode>=STEP)			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V3.0

Test Configuration

The commands of the following subsystems configure the signal power measurement. They correspond to the sections in the *Power Configuration* popup menu that are related to the access burst power measurement.

Subsystem POWer:ABURst...:TIME

The subsystem *POWer:ABURst...:TIME* contains the command for shifting the time axis (and thus the tolerance mask). The subsystem corresponds to the *Timing Bit Offset* hotkey in the graphical measurement menu *Power*.

CONFigure:POWer:ABURst[:GMSK]:TIME:BOFFset *<Offset>*	Bit Offset			
<Offset>	Description of parameters	Def. value	Def. unit	Unit ring
–4.00 to +4.00	Number of bits	0	bit	
Description of command				FW vers.
This command defines an offset time in ¼ bit units by which the burst is shifted relative to the time axis and the tolerance template.				V3.0

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:ABURst[:GMSK] Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–10 bit to 96 ¾ bit,	Start time in current range	–10	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 428	Number of samples in current range	428	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V3.0

Measured Values

The commands of the following subsystems determine and return the results of the access burst power measurement. They correspond to the graphical menu *Power* with its various display elements.

Subsystem POWer:ABURst...

The subsystem *POWer:ABURst...* contains the commands for measurement and output of the access burst power and its comparison with tolerance values. The subsystem corresponds to the graphical measurement menu *Power.*

READ[:SCALar]:POWer:ABURst[:GMSK]?	Scalar results Start single shot measurement and return results
FETCh[:SCALar]:POWer:ABURst[:GMSK]?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:ABURst[:GMSK]?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
Avg. Burst Pw. (Curr),	See data sheet	NAN	dBm	
Time of Arrival,	–100.0 bit to +100.0 bit	NAN	bit	
TSC detected,	OFF | GSM0 to GSM7 | DUMMy	NAN	–	
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command — FW vers. V3.0

These commands are always queries.

- `READ` starts a single shot measurement and returns the results.
- `FETCh` outputs the results without taking care of the measurement state.
- `SAMPle` waits until the results are valid for the first time (depending on the chosen statistic count) and then outputs the results.

For more details refer to the description of measurement control in chapter 5 of the CMU200 operating manual.

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

CALCulate:POWer:ABURst[:GMSK]:LIMit:MATChing? Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
Avg. Burst Pw. (Curr),	NMAU | NMAL | INV | OK	INV	–	–
BurstMatching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	

Description of command — FW vers. V3.0

This command is always a query. It indicates whether and in which way the tolerances for the scalar measured values (see command above) have been exceeded.

The following messages may be output for the value *AvgBurstPowerCurr*:

OK	Tolerance value matched	*OK.*
NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measured value invalid	*invalid*

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

Burst Power

READ:ARRay:POWer:ABURst[:GMSK]? Start single shot measurement and return results
FETCh:ARRay:POWer:ABURst[:GMSK]? Read measurement results (unsynchronized)
SAMPle:ARRay:POWer:ABURst[:GMSK]? Read results (synchronized)

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	FG
...	...	...	...	Power
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	Level

Description of command — FW vers. V3.0

These commands are always queries. They output the different power values of the bursts in a fixed ¼-bit pattern. The number of measured values is 428, corresponding to a time range of –10 bit to 96 ¾ bit.

		Subarray Results
READ:SUBarrays:POWer:ABURst[:GMSK]?	Start single shot meas. and return results	*RUN*
FETCh:SUBarrays:POWer:ABURst[:GMSK]?	Read meas. results (unsynchronized)	*RUN*
SAMPle:SUBarrays:POWer:ABURst[:GMSK]?	Read results (synchronized)	*RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	V3.0

CALCulate:ARRay:POWer:ABURst[:GMSK]:LIMit:MATChing?				**Limit Matching, Array**
Returned values	Value range	Def. value	Def. unit	Unit ring
Matching	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	–

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the burst power (see command above) have been exceeded. The following messages may be output for the value *Matching*: INV *invalid* MATC *matching* NMAT *not matching* OUT *out of range* NTR *no trigger* NRAM *not ramping (burst not found)* OFLW *overflow* UFLW *underflow* NTSC *no training sequence code* OFF *off*	V3.0

CALCulate:ARRay:POWer:ABURst[:GMSK]:AREA:LIMit:MATChing?				**Limit Matching, Area**
Returned value	Description of parameters	Def. value	Def. unit	Unit ring
32 bit value,	Indicator for upper limit matching in area 1 to 16 (16 least significant bits),	NAN	–	– –
32 bit value	Indicator for lower limit matching in area 1 to 16 (16 least significant bits)	NAN	–	

Description of command	FW vers.
This command is always a query. If a bit is set in the two returned values the corresponding section of the limit lines is exceeded.	V3.0

Subsystem POWer:PCL

The subsystem *POWer:PCL* controls the power vs PCL measurement. It corresponds to the measurement menu *Power* with the application *P/PCL*:

INITiate:POWer:PCL	Start new measurement	*RUN*
ABORt:POWer:PCL	Abort running measurement and switch off	*OFF*
STOP:POWer:PCL	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer:PCL	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V2.00

CONFigure:POWer:PCL:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).				V2.00

FETCh[:SCALar]:POWer:PCL:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).				V2.00

Subsystem POWer:PCL:CONTrol

CONFigure:POWer:PCL:CONTrol:REPetition *<Repetition>,<StopCondition>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single measurement *(single shot*, `until Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–

Description of command	FW vers.
This command determines the number of statistics cycles and the stepping mode for the measurement. **Note:** In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.	V2.00

Subsystem POWer:PCL:CHANnel

The subsystem *POWer:PCL:CHANnel* defines three or seven channels for the *P/PCL* measurement. The subsystem corresponds to the *Channel Count* hotkey and the MS Signal softkey in the measurement menu *P/PCL.*

CONFigure:POWer:PCL:CCOunt <Channels> Channel Count

<Channels>	Description of parameters	Def. value	Def. unit	Unit ring
C3 | C7	3 or 7 different channels measured	C3	–	–

Description of command	FW vers.
This command defines whether three or seven different channels are measured in the P/PCL measurement.	V2.15

CONFigure:POWer:PCL:CHANnel <Channel1>, ..., <Channeln> Channel

Channel<nr>	Value range	Def. value: Cannel 1,2,3	Def. unit	Unit ring
GSM400	259 to 293, 306 to 340	259,276,293	–	–
GSM850	128 to 251	128,190,251		
GSM900	0 to 124; 955 to 1023	1,62,124		
GSM1800	512 to 885	512,698,885		
GSM1900	512 to 810	512,661,810		

Description of command	FW vers.
This command defines the GSM channel numbers for the P/PCL measurement. The total number n of channels measured is either 3 or 7, depending on the `CONFigure:POWer:PCL:CCOunt` setting.	V2.00[4]

If 7 channels are measured, the following default values apply:

GSM400	259, 265, 270, 276, 282, 287, 293
GSM850	128, 149, 169, 190, 210, 230, 251
GSM900	1, 22, 42, 63, 83, 104, 124
GSM1800	512, 574, 636, 669, 761, 823, 885
GSM1900	512, 562, 611, 661, 711, 760, 810

Subsystem POWer:PCL

The subsystem *POWer:PCL* contains the commands for measurement and output of the power versus PCL application for three or seven selected channels. The subsystem corresponds to the measurement menu *P/PCL.*

Scalar Results

READ[:SCALar]:POWer:PCL? Start single shot measurement and return results
FETCh[:SCALar]:POWer:PCL? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:PCL? Read out measurement results (synchronized)

Return	Value range	Def. value	Def. unit	Unit ring
PCL1, P1Ch1,	**GSM400/850/900:**			
P1Ch2, P1Ch3,	PCL: 0 to 31	NAN	–	
	Power: 5.0 dBm to +39.0 dBm	NAN	dBm	
... ,	**GSM1800:**			
	PCL: 0 to 31	NAN		
PCLn, PnCh1,	Power: 0.0 dBm to +36.0 dBm	NAN	dBm	
PnCh2,PnCh3	**GSM1900:**			
	PCL: 0 to 31	NAN		
	Power: 0.0 dBm to +33.0 dBm	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return all measurement results. The returned list contains all possible PCLs of the mobile phone together with the measured MS output powers in the three selected channels. The output values are:	V2.00

- PCL1 to PCLn	*PCLs of the mobile*
- PxChy	*Average burst power for PCL = x and channel = y*

The PCL range depends on the GSM phase and the power class of the mobile. For a list of possible PCLs and nominal maximum output power of the mobiles refer to chapter 4.

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[4] In firmware versions <2.15, only three channels could be measured.

Scalar Results

READ[:SCALar]:POWer:PCL:PCLPower<PCL>? Start single shot measurement and return results
FETCh[:SCALar]:POWer:PCL:PCLPower<PCL>? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:PCL:PCLPower<PCL>? Read out measurement results (synchronized)

Returned Value	Value range	Def. value	Def. unit	Unit ring
PCh1, ... , P1Chn	See previous command	NAN	dBm	

Description of command	FW vers.
These commands are always queries. They start a measurement and return the mobile output power at one particular PCL specified with the numeric index <PCL> and for the channels specified via `CONFigure:POWer:PCL:CHANnel`. The total number n of channels measured is either 3 or 7, depending on the `CONFigure:POWer:PCL:CCOunt` setting. See also command description for `READ[:SCALar]:POWer:PCL[:CURRent]?`	V2.15

CALCulate:POWer:PCL[:CURRent]:LIMit:MATChing? Results of Limit Check

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
Matching	OK | NMAU | NMAL | INV	INV	–	

Description of command

FW vers. V2.00

This command is always a query. It indicates whether and in which way the tolerances for the burst power (see preceding command) are exceeded. The tolerance values are set via `CONF:POW:LIM:ABP<nr>`.

The following messages may be output for the measured value *Matching*:

OK	Tolerance value matched	*OK.*
NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measured value invalid	*invalid*

The complete output list reports the limit matching for all measured PCLs and the three or seven channels defined via `CONFigure:POWer:PCL:CHANnel`, starting with the channels for the first PCL, e.g. (for three channels):

1, OK, OK, OK, 2, OK, OK, OK, 3, OK, OK, OK, ...

POWer:MPR

The subsystem *POWer:MPR* combines the *POWer* and *MODulation* systems, i.e. it measures the signal power vs. time and the scalar modulation parameters simultaneously. The subsystem contains all commands for measurement control and for the output of measurement results; configurations such as limit lines must be defined separately in the *POWer* and *MODulation* systems.

The *POWER:MPR* has no equivalent in manual control where the power and modulation measurement results are displayed separately.

Control of measurement – Subsystem POWer:MPR

The subsystem *POWer:MPR* controls the combined power and modulation measurement.

INITiate:POWer[:NORMal][:GMSK]:MPR	Start new measurement	*RUN*
ABORt:POWer[:NORMal][:GMSK]:MPR	Abort running measurement and switch off	*OFF*
STOP:POWer[:NORMal][:GMSK]:MPR	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer[:NORMal][:GMSK]:MPR	Next meas. step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the combined power and modulation measurement, setting it to the status indicated in the top right column.	2.00

CONFigure:POWer[:NORMal][:GMSK]:MPR:EREPorting *<Mode>* Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).	2.00

FETCh:POWer[:NORMal][:GMSK]:MPR:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	–
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	–
NONE	Statistic count set to off			

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).	2.00

Subsystem POWer:MPR:CONTrol

The subsystem *POWer:MPR:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement.

CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol *<Mode>, <Statistics>*

Scope of Measurement

<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	–
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	–
Description of command				FW-Vers.
This command specifies the type of measured values and defines the number of bursts forming a statistics cycle.				2.00

CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	–
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	–
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	–
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.				2.00

Test Configuration

The commands of the following subsystems configure the combined power and modulation measurement. Note that configurations such as limit lines must be defined separately in the *POWer* and *MODulation* systems.

Subsystem SUBarrays:POWer:MPR

The subsystem *SUBarrays:POWer:MPR* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR <Mode>,<Start>,<Samples>{,<Start>,<Samples>}				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum |** **IVAL,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range Return single interpolated value at <Start>	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–10 bit to 156 ¾ bit,	Start time in current range	–10	bit	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 668	Number of samples in current range	668	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:POWer:MPR` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of ¼ bit. If <Start> does not coincide with a test point then the range will start at the next test point that is larger than <Start>. For <Mode> = IVAL, the <Samples> parameter is ignored and the CMU returns a single measurement value corresponding to the abscissa value <Start>. If <Start> is located beween two test points with valid results then the result is calculated from the results at these two adjacent test points by linear interpolation. The subranges may overlap but must be within the total range of the *Power* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				2.00

Measured Values – Subsystem POWer:MPR

The subsystem *POWer:MPR* determines and outputs the results of the combined power and modulation measurement.

Scalar Results

READ[:SCALar]:POWer[:NORMal][:GMSK]:MPR? Start single shot measurement and return results
FETCh[:SCALar]:POWer[:NORMal][:GMSK]:MPR? Read out meas. results (unsynchronized)
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]:MPR? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PeakBurstPwCurr,	–137 dBm to +53 dBm	NAN	dBm	
PowerControlLevel,	0 to 32 (dep. on network, power class...)	NAN	PCL	
TimingAdvError,	–100.0 bit to +100.0 bit	NAN	bit	
BurstsOutOfTol,	0.0% too 100.0%	NAN	%	
BurstMatching,	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
PhErrPeakCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrPeakMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSCurrent,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSAverage,	–100.0 ° to +100.0 °	NAN	deg	
PhErrRMSMaxMin,	–100.0 ° to +100.0 °	NAN	deg	
FreqErrCurrent,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrAverage,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
FreqErrMaxMin,	–1000.0 Hz to + 1000.0 Hz	NAN	Hz	
AvgBurstPwAvg	–137 dBm to +53 dBm	INV	dBm	

Description of command	FW vers.
These commands are always queries. They start a combined power vs. time and modulation measurement and output all scalar measurement results. For detailed information refer to the description of the analogous commands in the POWer and MODulation systems.	2.00

Traces

READ:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Start measurement and wait for end *RUN*

FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read meas. results (unsynchronized) *RUN*

SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?
Read results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern. The number of measured values is 668, corresponding to a time range of –10 bit to 156 ¾ bit. The calculation of *current, average, minimum* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.00

READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?

Subarray Results

READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?

Start measurement and wait for end *RUN*

FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?

Read meas. results (unsynchronized) *RUN*

SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?

Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB to + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB to + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in a fixed ¼- bit pattern and in the subranges defined by means of the `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (cf. *display mode*).	2.00

CALCulate:POWer[:NORMal][:GMSK]:MPR:LIMit:MATChing? Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
AvgBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
PeakBurstPwCurr,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching,	INV | MATC | NMAT | OUT | NTR | NRAM | OFLW | UFLW | NTSC | OFF	INV	–	
PhErrPeakCurrent,	For all measured values: NMAU | NMAL | INV | OK	INV	–	–
PhErrPeakAverage,		INV	–	
PhErrPeakMaxMin,		INV	–	
PhErrRMSCurrent,		INV	–	
PhErrRMSAverage,		INV	–	
PhErrRMSMaxMin,		INV	–	
FreqErrCurrent,		INV	–	
FreqErrAverage,		INV	–	
FreqErrMaxMin,		INV	–	
AvgBurstPwAvg		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the scalar results (see command above) in the *power vs time* and the *modulation* measurement have been exceeded.	2.00

The following messages may be output for the values *AvgBurstPower (current or average)* and *PeakBurstPower* and for all results of the modulation measurement:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

The following messages may be output for the value *BurstMatching*:

INV	*invalid*
MATC	*matching*
NMAT	*not matching*
OUT	*out of range*
NTR	*no trigger*
NRAM	*not ramping (burst not found)*
OFLW	*overflow*
UFLW	*underflow*
NTSC	*no training sequence code*
OFF	*off*

Receiver Quality

The subsystem *RXQuality* comprises the commands for all receiver quality measurements. The subsystem corresponds to the main menu *Receiver Quality* and the associated popup menu *Receiver Quality Configuration.*

Important Note: ***Receiver Quality Measurements with MCS-5 to MCS-9***

> *Receiver Quality measurements on circuit-switched channels using the modulation and coding schemes MCS-5 to MCS-9 (see* `CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic` *command on p. 6.179) can not be performed in parallel to TX Tests (*`POWer...`*,* `MODulation...`*,* `SPECtrum`*). The Receiver Quality measurement must be in the READY or OFF state before a TX Test can be started. Conversely, all TX Tests must be in the READY or OFF state before a Receiver Quality measurement using MCS-5 to MCS-9 can be started.*

Test Configuration – Subsystem RXQuality:CONTrol

The subsystem *RXQuality:CONTrol* controls the receiver quality measurements.

CONFigure:RXQuality:CONTrol:HTIMe <AGCTime>, <*SynchTime*> AGC Holdoff Time, Sync Holdoff Time

<AGCTime>	Description of parameters	Def. value	Def. Unit	Unit ring
0 s to 100 s	Automatic gain control	0.5	s	Time
<SynchTime>	Description of parameters	Def. value	Def. Unit	Unit ring
0 s to 100 s	Bit stream synchronization	0.2	s	Time

Description of command	FW vers.
This command defines hold off times during which the mobile can adapt itself to the new RF level at the beginning of the *Receiver Quality* measurement and send back the bit stream received. By reducing the hold off times, the measurement can be speeded up. The default settings for both times do not depend on the application.	≥2.00

CONFigure:RXQuality:CONTrol:DEFault <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to default values The parameters partly or completely differ from the default value	ON	–	–

Description of command	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	≥2.00

Receiver Quality – Single Shot

The subsystem *RXQuality:BER* contains the commands for receiver quality measurements in the single shot repetition mode. The subsystem corresponds to the main menu *Receiver Quality,* application *BER*, and the corresponding sections of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the single shot receiver quality measurements.

CONFigure:RXQuality:BER:TSETup <*TestSetup*>				Test Setup
<TestSetup>	Description of parameters	Def. value	Def. unit	Unit ring
T1 |	Single Shot Test Setup 1	T1	–	–
T2 |	...			
...				
T10	Single Shot Test Setup 10			
Description of command				FW vers.
This command selects one out of 10 test setups, i.e. one data set parametrizing a particular single shot receiver quality measurement. When a new test setup is selected, the running measurement is aborted (measurement state *OFF)* and all measured values are set to *INV* (invalid). The new measurement must be re-started with `INITiate:RXQuality:BER`.				≥2.00

INITiate:RXQuality:BER	Start new measurement	*RUN*
ABORt:RXQuality:BER	Abort running measurement and switch off	*OFF*
STOP:RXQuality:BER	Stop measurement	*STOP*
CONTinue:RXQuality:BER	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the current single shot measurement, setting it to the status indicated in the top right column.		≥2.00

CONFigure:RXQuality:BER:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).				≥2.00

FETCh:RXQuality:BER:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 50000 |	Counter for current evaluation period (frame)	NONE	–	–
NONE	Statistic count set to off (only 1 frame)			
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).				≥2.00

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* sets the control parameters for the single shot receiver quality measurements. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER<nr>:CONTrol *<Mode>, <FramesToSend>* Meas. Mode, Frames

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER |	Residual bit error rate, frame erasure rate	BER	–	
BER	Bit error rate			
BBB	Burst by burst			
BDBL	BER/Data Block Error Rate			

<FramesToSend>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 50000 |	No. of frames to be sent	See below	–	
NONE	No average (only 1 frame considered)			

Description of command	FW vers.
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> refers to the selected test setup (<nr> = 1 to 10). For definition of the measured value (BER, RFER etc.) see chapter 4.	≥2.00

The following default settings are valid for the command parameters:

<nr>	1	2	3	4	5	6	7	8	9	10
Mode	BER	BER	BER	BER	BER	BER	BER	BER	BER	BER
Frames	100	100	500	500	100	500	500	100	100	100

CONFigure:RXQuality:BER<nr>:CONTrol:REPetition
***<StopCondition>*,<Stepmode>** Test Cycles

<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
ALIMits |	Measurement aborted when all limits are exceeded	See below	–	–
FLIMit |	Aborted when first limit value is exceeded			
NONE	Not aborted, measurement over all frames			

<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the stop condition and the stepping mode for the measurement. The repetition mode of the measurement (single shot) is identified by the `BER` keyword.	≥2.00

Depending on the test setup, the following default settings are valid:

<nr>	1	2	3	4	5	6	7	8	9	10
StopCond	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM	FLIM

CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel:UTIMeslot *<Level>*

TCH Level BER, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	See below	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot		dBm	
–90 dBm to +13 dBm	RF3 OUT level in used timeslot		dBm	

Description of command	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the single shot application <nr>. This level applies to the receiver quality measurement only.	≥2.00

The default setting depends on the test setup (all level values in dBm, corresponding to RF2):

<nr>	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel:UNTimeslot *<Level>*

TCH Level BER, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	See below	dB	

Description of command	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the single shot application <nr>. This level applies to the receiver quality measurement only. The level range quoted above is restricted by the condition that the absolute level (calculated from the used timeslot level and the relative level in the unused timeslots) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a default used timeslot level of –102 dBm, the unused timeslot level can be set in the range –35 dB to +92 dB, corresponding to an absolute level of –137 dBm to –10 dBm.	≥2.00

The default setting depends on the test setup (all level values in dB):

<nr>	1	2	3	4	5	6	7	8	9	10
Level	–18.0	–16.0	–18.0	–16.0	–20.0	–20.0	–20.0	–18.0	–18.0	–18.0

Reference Level, Multislot

CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:MSLot:RLEVel _<Level>_
CONFigure:RXQuality:BER<nr>:CONTrol:PDATa:[:TCH]:MSLot:RLEVel _<Level>_

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	Reference level for RF1	See below	dBm	
–137 dBm to –10 dBm	Reference level for RF2	See below	dBm	
–90 dBm to +13 dBm	Reference level for RF3 OUT	–90	dBm	

Description of command	FW vers.
This command defines the reference value for the individual downlink (BS) TCH signal levels used for the multislot BER test on circuit switched channels. See command `CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:MSLot:LEVel:INDividual` on p. 6.148 and the corresponding packet data command.	≥3.05

The default setting depends on the test setup (all level values in dB):

<nr>	1	2	3	4	5	6	7	8	9	10
Level	–102.0	–104.0	–102.0	–104.0	–100.0	–100.0	–100.0	–102.0	–102.0	–102.0

Slot Configuration: Individual (Multislot)

CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:MSLot:LEVel:INDividual
CONFigure:RXQuality:BER<nr>:CONTrol:PDATa[:TCH]:MSLot:LEVel:INDividual
_<Level_0>, ..., <Level_7>_

_<Level_n>_	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n	0	dB	

Description of command	FW vers.
This command defines the levels in all 8 timeslots of the downlink (BS) TCH signal relative to the _Reference Level_ set via **CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:MSLot:RLEVel _<Level>_** **CONFigure:RXQuality:BER<nr>:CONTrol:PDATa:[:TCH]:MSLot:RLEVel _<Level>_** (see p. 6.148) and the corresponding packet data command. The levels are valid for BER tests if the MS is set to multislot operation.	V3.05

The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors.

Example: With output connector RF2 and a default used timeslot level of –102 dBm, the individual levels can be set in the range –35 dB to +92 dB, corresponding to absolute levels of –137 dBm to –10 dBm.

The PDATa command refers to packet-switched data traffic channels and requires option CMU-K42.

Slot Configuration: Individual (Single-Slot)

CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:ZERO *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:ONE *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:TWO *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:THRee *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:FOUR *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:FIVE *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:SIX *<Level>*
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel[:SLOT]:SEVen *<Level>*

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n	0	dB	–

Description of command	FW vers.
This command defines the levels in all 8 timeslots of the downlink (BS) TCH signal relative to the *Reference Level* set via `CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]:LEVel:REFLevel` (see p. 6.148). The levels are valid for BER tests if the MS is set to multislot operation. The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors. **Example** With output connector RF2 and a default used timeslot level of –102 dBm, the individual levels can be set in the range –35 dB to +92 dB, corresponding to absolute levels of –137 dBm to –10 dBm.	V3.05

CONFigure:RXQuality:BER<nr>:CONTrol:DEFault <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	≥2.00

Subsystem RXQuality:BER:LIMit

The subsystem *RXQuality:BER:LIMit* defines tolerance values for the single shot receiver quality measurements. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER<nr>:LIMit:CLII *<ClassIIBER>* Class II Bits

<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	0.2	%	

Description of command	FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) in test setup <nr>. Irrespective of the test setup, the default setting is 0.2 %.	≥2.00

CONFigure:RXQuality:BER<nr>:LIMit:CLIB <*ClassIbBER*> Class Ib Bits

<ClassIbBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	

Description of command	FW vers.
This command defines an upper limit for the bit error rate of class Ib (partly protected bits, see chapter 4) in the test setup <nr>. Irrespective of the test setup, the default setting is 0.4 %.	≥2.00

CONFigure:RXQuality:BER<nr>:LIMit:FERRors <Frame Errors> Frame Errors

<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	

Description of command	FW vers.
This command defines an upper limit for frame errors in the test setup <nr>. Irrespective of the test setup, the default setting is 0.1 %.	≥2.00

CONFigure:RXQuality:BER<nr>:LIMit:DBLer <Data_BLER> Data Block Error Rate

<Data_BLER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for data block error rate	10.0	%	

Description of command	FW vers.
This command defines an upper limit for the data BLER in the test setup <nr>. Irrespective of the test setup, the default setting is 10.0 %.	≥3.05

CONFigure:RXQuality:BER<nr>:LIMit:USFBler <USF_BLER> USF Block Error Rate

<USF_BLER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for USF block error rate	1.0	%	

Description of command	FW vers.
This command defines an upper limit for the USF BLER in the test setup <nr>. Irrespective of the test setup, the default setting is 10.0 %.	≥3.05

CONFigure:RXQuality:BER<nr>:LIMit:DEFault <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	≥2.00

Measured Values – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* measures and outputs the bit error rate and compares it with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* for the single shot type of measurement and measured values *(RFER, BER, BurstByBurst)*.

Scalar Results

READ[:SCALar]:RXQuality:BER?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:BER?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:BER?	Read out measurement results (synchronized)

Returned values for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
ClassIIBits,	0.000% to 100.000%	NAN	%	
ClassIbBits,	0.000% to 100.000%	NAN	%	
FER,	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 50000	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Returned values for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
ClassIIBits,	0.000% to 100.000%	NAN	%	
ClassIbBits,	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 50000	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Returned values for BBB	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
BER,	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 50000	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Returned values for BDBL	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
BER,	0.000% to 100.000%	NAN	%	
USFBLER	0.000% to 100.000%	NAN	%	
DBLER	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 50000	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Description of command	FW vers.
These commands are always queries. They start a bit-error-rate test in the single shot repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:BER<nr>:CONTrol` command (RFER, BER, BBB, DBLer). They are	≥2.00

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
FER	Frame erasure rate
BER	Bit error rate (no distinction between bit classes)
DBLER	Data block error rate
USFBLER	USF block error rate, available for packet-switched channels only (CMU-K42)
CRCErrors	Cyclic redundancy check (CRC) errors
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	All tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:BER:LIMit:MATChing? Limit Matching

Returned values for RFER	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
FER,	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	
Returned values for BER	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
CRC	NMAU | INV | OK	INV	–	
Returned values for BBB	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
BER,	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	
Returned values for BDBL	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
BER,	NMAU | INV | OK	INV	–	
USFBLER	NMAU | INV | OK	INV	–	
DBLER	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the bit error rate test (see command above) have been exceeded.	≥2.00

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK.	all tolerances matched	

Receiver Quality – Continuous

The subsystem *RXQuality:BAVerage* contains the commands for receiver quality measurement with continuous repetition. The subsystem corresponds to the main menu *Receiver Quality*, application *BER Average* and the corresponding parts of the associated popup menu *Receiver Quality Configuration.*

Control of Measurement – Subsystem RXQuality:BAVerage

The subsystem *RXQuality:BAVerage* controls the *Continuous* measurement.

INITiate:RXQuality:BAVerage	Start new measurement	*RUN*
ABORt:RXQuality:BAVerage	Abort running measurement and switch off	*OFF*
STOP:RXQuality:BAVerage	Stop measurement	*STOP*
CONTinue:RXQuality:BAVerage	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the Continuous measurement, setting it to the status indicated in the top right column.		≥2.00

CONFigure:RXQuality:BAVerage:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	–
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).				≥2.00

FETCh:RXQuality:BAVerage:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 500 |	Number of frames to average			
NONE	No averaging	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).				≥2.00

Subsystem RXQuality:BAVerage:CONTrol

The subsystem *RXQuality:BAVerage:CONTrol* sets the parameters for the continuous receiver quality measurement. The subsystem corresponds to the tab *Control* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BAVerage:CONTrol <*Mode*>, <*FramesToAverage*> Meas. Mode, Average

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
RFER |	Residual bit error rate, frame erasure rate	BER	–	
BER	Bit error rate			
BBB	Burst by burst			
BDBL	BER/Data Block Error Rate			
<FramesToAverage>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 500 |	No. of frames to average	100	–	
OFF	No average (only 1 frame considered)			

Description of command	FW vers.
This command defines the measured value and the number of frames to be averaged in the continuous measurement, constituting a statistics cycle. For definition of the measured value (BER, RBER etc.) see chapter 4.	≥2.00

CONFigure:RXQuality:BAVerage:CONTrol:REPetition <*StopCondition*> ,<Stepmode> Stop Condition

<StopCondition>	Description of parameters	Def. value	Def. Unit	Unit ring
ALIMits |	Measurement aborted when all limits are exceeded	FLIM	–	–
FLIMit |	Aborted when first limit value is exceeded			
NONE	Not aborted, measurement over all frames			
<Stepmode>	Description of parameters	Def. value	Def. Unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	FW vers.
This command determines the stop condition and the stepping mode for the measurement.	≥2.00

CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UTIMeslot <*Level*> TCH BER Level, Used Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–102.0	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–102.0	dBm	
–90 dBm to +13 dBm	RF3 OUT level in used timeslot	–90.0	dBm	

Description of command	FW vers.
This command defines the absolute level of the traffic channel (*TCH*) in the used timeslot for the continuous application. This level applies to the *Receiver Quality* measurement only	≥2.00

CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UNTimeslot *<Level>*

TCH BER Level, Unused Timeslot

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	–18.0	dB	Ratio

Description of command	FW vers.
This command defines the relative level of the traffic channel (*TCH*) in the unused timeslot for the continuous application. This level applies to the receiver quality measurement only. The value range mentioned above is valid provided that the sum of the absolute level of the used timeslot and the relative value for the unused timeslot does not exceed the value ranges for the absolute level of the used timeslot (for RF1, RF2 and RF3 OUT).	≥2.00

Reference Level, Multislot

CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:RLEVel *<Level>*
CONFigure:RXQuality:BAVerage:CONTrol:PDATa[:TCH]:MSLot:RLEVel *<Level>*

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 reference level	–102.0	dBm	
–137 dBm to –10 dBm	RF2 reference level	–102.0	dBm	
–90 dBm to +13 dBm	RF3 OUT reference level	–90.0	dBm	

Description of command	FW vers.
This command defines the reference value for the individual downlink (BS) TCH signal levels used for the multislot BAVerage test on circuit switched channels. See command `CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:LEVel:INDividual` on p. 6.155 and the corresponding packet data command.	≥3.05

Slot Configuration: Individual (Multislot)

CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:LEVel:INDividual
CONFigure:RXQuality:BAVerage:CONTrol:PDATa[:TCH]:MSLot:LEVel:INDividual
<Level_0>, ..., <Level_7>

<Level_n>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n	0	dB	

Description of command — FW vers. V3.05

This command defines the levels in all 8 timeslots of the downlink (BS) TCH signal relative to the *Reference Level* set via `CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:RLEVel` (see p. 6.155) and the corresponding packet data command. The levels are valid for BER tests if the MS is set to multislot operation.

The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors.

Example: With output connector RF2 and a default used timeslot level of –102 dBm, the individual levels can be set in the range –35 dB to +92 dB, corresponding to absolute levels of –137 dBm to –10 dBm.

The `PDATa` command refers to packet-switched data traffic channels and requires option CMU-K42.

CONFigure:RXQuality:BAVerage:CONTrol:DEFault <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to default values The parameters partly or completely differ from the default value	ON	–	–
Description of command				FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.				≥2.00

Subsystem RXQuality:BAVerage:LIMit

The subsystem *RXQuality:BAVerage:LIMit* defines tolerance values for the continuous receiver quality measurement. The subsystem corresponds to the tab *Limits* in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BAVerage:LIMit:CLII *<ClassIIBER>*				Class II Bits
<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class II bits	0.2	%	
Description of command				FW vers.
This command defines an upper limit for the bit error rate of class II (unprotected bits, see chapter 4) for continuous application.				≥2.00

CONFigure:RXQuality:BAVerageLIMit:CLIB *<ClassIbBER>*				Class Ib Bits
<ClassIbBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of error rate for class Ib bits	0.4	%	
Description of command				FW vers.
This command defines an upper limit for the bit error rate of class Ib (partly protected bits, see chapter 4) for the continuous application.				≥2.00

CONFigure:RXQuality:BAVerage:LIMit:FERRors <Frame Errors>				Frame Errors
<FERRors>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for erased frame errors	0.1	%	
Description of command				FW vers.
This command defines an upper limit for the relative portion of invalid and therefore erased frames (*frame erasure rate*, see chapter 4) in the measurement of the residual bit error rate (*RBER*, see command `CONFigure:RXQuality:BAVerage:CONTrol`) and for the continuous application.				≥2.00

CONFigure:RXQuality:BAVerage:LIMit:DBLer <Data_BLER>				Data Block Error Rate
<Data_BLER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for data block error rate	10.0	%	
Description of command				FW vers.
This command defines an upper limit for the data BLER.				≥3.05

CONFigure:RXQuality:BAVerage:LIMit:USFBler <USF_BLER> USF Block Error Rate

<USF_BLER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit for USF block error rate	10.0	%	

Description of command	FW vers.
This command defines an upper limit for the USF BLER.	≥3.05

CONFigure:RXQuality:BAVerage:LIMit:DEFault <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to default values The parameters partly or completely differ from the default value	ON	–	–

Description of command	FW vers.
As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command reads out whether all parameters are set to default values *(ON)* or not *(OFF)*.	≥2.00

Measured Values – Subsystem RXQuality:BAVerage

The subsystem *RXQuality:BAVerage* contains the commands for measurement and output of the bit error rate and its comparison with the tolerance values. The subsystem corresponds to the measurement menus *Receiver Quality* for the continuous measurement.

Scalar Results

FETCh[:SCALar]:RXQuality:BAVerage? Read out results (unsynchronized)

SAMPle[:SCALar]:RXQuality:BAVerage? Read out results (synchronized)

Returned values for RFER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
FER,	0.000 to 100.000 %	NAN	%	
CRCErrors,	0 to 500	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	
Returned values for BER	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0 to 100.0 %	NAN	%	
ClassIIBits,	0.000 to 100.000 %	NAN	%	
ClassIbBits,	0.000 to 100.000 %	NAN	%	
CRCErrors,	0 to 500	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	
Returned values for BBB	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
ClassIIBits,	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 500	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Returned values for BDBL	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.0% to 100.0%	NAN	%	
BER,	0.000% to 100.000%	NAN	%	
USFBLER	0.000% to 100.000%	NAN	%	
DBLER	0.000% to 100.000%	NAN	%	
CRCErrors,	0 to 500	NAN	–	
Status	INV | PASS | FAIL | TLOW | IMP	INV	–	

Description of command	FW vers.
These commands are always queries. They start a bit error rate test in the continuous repetition mode and output the measurement results (see also detailed explanation of measured values in chapter 4). The results depend on the measurement mode set via the `CONFigure:RXQuality:BAVerage<nr> :CONTrol` command (RFER, BER etc.). They are	≥2.00

ProgressTime	Relative progress of the measurement
ClassIIBits	(Residual) bit error rate for class II bits
ClassIbBits	(Residual) bit error rate for class Ib bits
BER	Bit error rate (no distinction between bit classes)
FER	Frame erasure rate
DBLER	Data Block Error Rate
USFBLER	USF block error rate, available for packet-switched channels only (CMU-K42)
CRCErrors	Cyclic redundancy check (CRC) errors
Status	Measurement status

The following messages can be output for the measurement status:

INV	Measurement invalid	*invalid*
PASS	All tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
IMP	Measurement impossible, therefore invalid	*impossible*

CALCulate:RXQuality:BAVerage:LIMit:MATChing? Limit Matching

Returned values for RFER	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
FER,	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	
Returned values for BER	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
ClassIIBits,	NMAU | INV | OK	INV	–	
ClassIbBits,	NMAU | INV | OK	INV	–	
CRC	NMAU | INV | OK	INV	–	
Returned values for BBB	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
BER,	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	
Returned values for BDBL	Value range	Def. value	Def. unit	Unit ring
Total,	PASS | FAIL | INV | TLOW | IMP	INV	–	
BER,	NMAU | INV | OK	INV	–	
USFBLER	NMAU | INV | OK	INV	–	
DBLER	NMAU | INV | OK	INV	–	
CRCErrors	NMAU | INV | OK	INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the bit error rate test (see command above) have been exceeded.	≥2.00

The following messages can be output for the measured quantities:

PASS	all tolerances matched	*passed*
FAIL	Not all tolerances matched	*failed*
INV	Invalid measurement	*invalid*
IMP	Measurement impossible, therefore invalid	*impossible*
NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK.	all tolerances matched	

Symbolic Status Event Register Evaluation

The following commands are used to retrieve the events reported in function groups *GSM400/850/900/1800/1900-MS Signalling*; see section *Symbolic Status Event Register Evaluation* in Chapter 5 of the CMU operating manual.

STATus:OPERation:SYMBolic:ENABle <Event>{,<Event>} Symbolic status evaluation

Parameter list	Parameter description	Def. Value[5]	Default Unit	Unit Ring
<Event>{,<Event>} | **NONE**	List of symbols for events to be reported No event reported	NONE	–	

Command description	FW vers.
This command enables event reporting for one or several events in the current *GSMxxx-MS Signalling* function group, i.e. it sets the corresponding bits in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr event>:ENABle` register (`<nr> = 1 | 2, <nr event>` denotes the current function group) and in all sum registers up to the status byte. The events and the corresponding symbols for the function group are listed in Chapter 5 (see section *Status Registers)*. The symbols may be entered in arbitrary order.	V3.05

STATus:OPERation:SYMBolic[:EVENt]? Symbolic status evaluation

Response	Parameter description	Def. Value[6]	Default Unit	Unit Ring
NONE | **<Event>{,<Event>}**	No event in the *RF* function group List of reported events	NONE	–	

Command description	FW vers.
This command is always a query. It lists the events reported in the current *GSMxxx-MS Signalling* function group and deletes these events in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:EVENt` register as well as in all sum registers.	V3.05

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[5] The default values quoted in this command are achieved after a `STATus:PRESet` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

[6] The default values quoted in this command are achieved after a `*CLS` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

GSM Mobile Tests (Signalling)

In the *Signalling* mode, the CMU is able to generate BCCH and TCH signals and to set up a connection to the mobile. A broad range of signalling parameters can be configured and measurements may be performed with a connection established.

Connection Control

The remote-control commands presented in this section control the signalling (connection setup and release, services, signalling parameters), determine the inputs and outputs as well as the reference frequency. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu.

Important note: Current vs. default values

> *Some parameters of the CMU assume two independent values: The default value is used to set up a connection; it can be modified in the signalling states Signal Off, Signal On and Registered. The current value during the connection (signalling state Call Established) can still be changed, however, modifying this current value does not alter the default value. An example for such a double parameter in GSM-MS is the BS signal level in the used and unused timeslots.*
>
> *Default values are set with a* `CONFigure ...` *command, current values are set with the corresponding* `PROCedure ...` *command.*

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *MS Signal* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE *<Mode>*				Input Level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | **PCLevel |** **AUTomatic**	Manual setting of max. input level According to power control level of the mobile Automatic setting corresponding to average power of signal applied	PCLevel	–	–
Description of command				FW vers.
This command defines the mode for setting the maximum input level.				≥1.15

[SENSe:]LEVel:MAXimum *<Level>*				Max. Level
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–40 dBm to +53 dBm	Maximum input level for RF1	+30.0	dBm	
–54 dBm to +39 dBm	Maximum input level for RF2	+30.0	dBm	
–77 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	
Description of command				FW vers.
This command defines the maximum input level. The value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).				≥1.15

[SENSe:]LEVel:ATTenuation <*Mode*> Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal |	Mixer level in normal range	LNOise	–	–
LNOise |	Low noise (mixer level 10 dB higher than in normal setting)			
LDIStortion	Low distortion (mixer level 10 dB lower than in normal setting)			

Description of command	FW vers.
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).	≥1.15

[SENSe:]LEVel:DEFault <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All parameters are set to their default values	ON	–	–
OFF	All or some parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	2.00

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the table section *Trigger* in the *MS Signal* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*> Trigger Source

<Source>	Description of parameters	Def. value	Def. unit	Unit ring
SIGNalling |	The measurement is triggered by the signalling unit	SIGN	–	–
FRUN |	The measurement is triggered by the TDMA timing (free-run mode) of the analyzed signal.			
RFPower |	Wideband power trigger.			
IFPower	Narrow-band trigger.			

Description of command	FW vers.
This command defines the trigger mode. The setting *FRUN* requires burst signals with incorporated training sequence.	≥1.15

TRIGger[:SEQuence]:THReshold <*Threshold*> Trigger Level

<Threshold>	Description of parameters	Def. value	Def. unit	Unit ring
LOW |	Low trigger threshold (reference level –26 dB)	LOW	–	–
MEDium |	Medium trigger threshold (ref. level –16 dB)			
HIGH	High trigger threshold (reference level –6 dB)			

Description of command	FW vers.
This command sets the signal level at which the measurement is triggered (see `TRIG:SEQ:SOUR`). The command is enabled for trigger source `RFPower` and `IFPower` only.	≥1.15

TRIGger[:SEQuence]:DEFault *<Enable>*				Trigger Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	All parameters are set to their default values All or some parameters differ from the default values	ON	–	–
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				2.00

Signalling – Subsystem SIGNalling (Connection Setup and Cleardown)

The subsystem *SIGNalling* controls the connection setup and cleardown from the CMU to the mobile and determines the signalling parameters. Together with the subsystem *WPOWer* it corresponds to the different *Signalling* tabs (for different signalling states, see command `PROCedure:SIGNalling[:CSWitched]:ACTion`) in the popup menu *Connect. Control*.

PROCedure:SIGNalling[:CSWitched]:ACTion *<Action>*				Signalling Control
<Action>	Description of parameters	Def. value	Def. unit	Unit ring
SOFF | **SON |** **MTC |** **SMS |** **CRELease |** **HANDover**	Switch off BCCH signal *(signal off)* Switch on BCCH signal *(signal on)* Mobile terminating call Short message service Call release Handover (to target network defined via `CONFigure:HANDover:TARGet`)	–	–	–
Description of command			Sig. State	FW vers.
This command has no query form. It changes between the different signalling states of the CMU. The current state can be queried via `SIGN:STAT?`			See below	≥1.15

Important Note: Signalling States and Local to Remote Switchover

The default signalling state of the CMU in remote control is SOFF (see Fig. 6-1 below). This state is automatically reached on switchover from manual to remote control; an existing connection to the MS under test is dropped.

To suspend this default behavior of the CMU, the base system command `SYSTem:GTRM:COMP` has been introduced. `SYSTem:GTRM:COMP OFF` prevents the instrument from changing the signalling state local to remote switchover. In particular, an existing connection is maintained. The default behavior of the CMU is restored each time the instrument is rebooted. For more information see the documentation of the base system commands in the CMU manual.

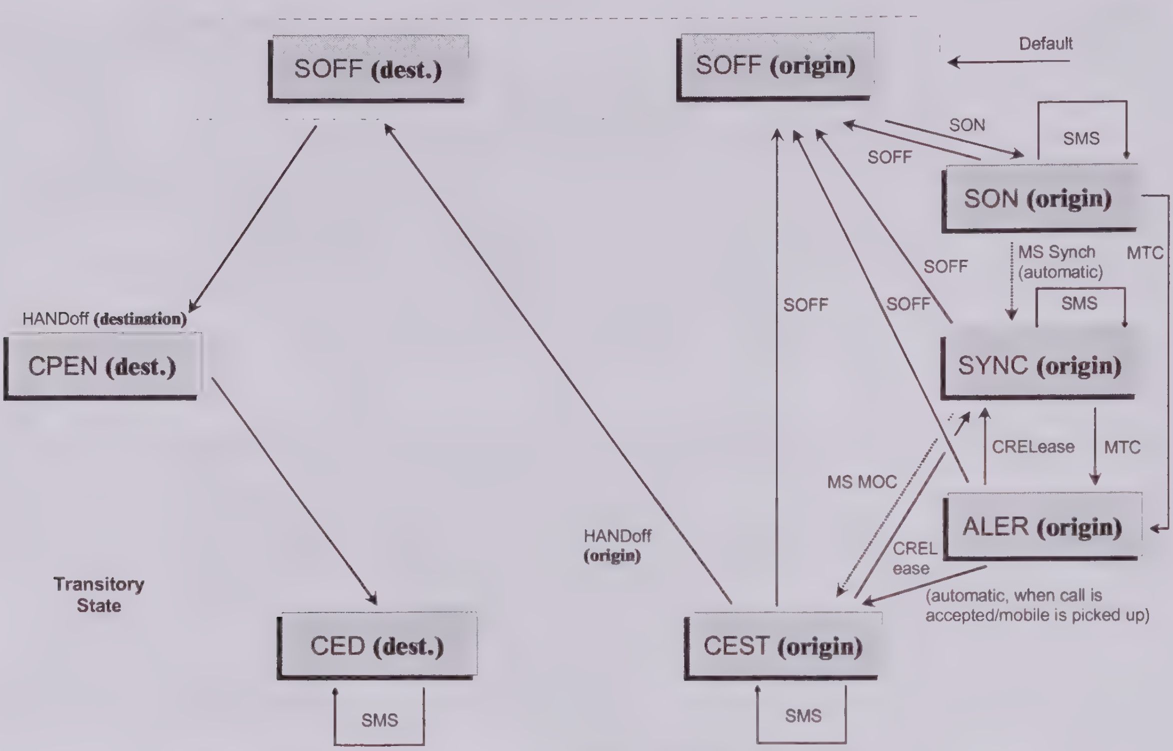

Fig. 6-1 Signalling states of the CMU and transitions including handover

Signalling states:

SOFF	signal off	CEST	call established
SON	signal on	CPEN	call pending
SYNC	synchronized	CED	call established dual band
ALER	alerting		

Actions:	*initiated from the CMU:*	*initiated from the mobile phone:*	
	See description of command	MS Synch	Synchronization of mobile phone
		MS MOC	Mobile originated call

Further transitions between the signalling states (not shown in Fig. 6-1) may occur, e.g. in case of errors (see chapter 4 of this manual).

[SENSe:]SIGNalling[:CSWitched]:STATe?				Signalling State
Return	Description of parameters	Def. value	Def. unit	Unit ring
SOFF |	Signal for synchronization switched off *(signal off)*	SOFF	–	–
SON |	Signal for synchronization switched on *(signal on)*			
SYNC |	Synchronization of CMU and mobile phone and location update established *(synchronized)*			
ALER |	Mobile is ringing *(Alerting)*			
CEST |	Call to mobile set up *(call established)*			
CPEN |	Call pending			
CED	Call established dual band			
Description of command			Sig. State	FW vers.
This command is always a query. It returns the current signalling state.			all	≥1.15

PROCedure:SIGNalling[:CSWitched]:DAI *<Interface>*				DAI Acoustic Dev.
<Interface>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal | **DECoder |** **ENCoder |** **ADEVice**	Default setting active during call setup Test of speech decoder / DTX functions (downlink) Test of speech encoder / DTX functions (uplink) Test of acoustic devices and A/D & D/A	NORM	–	
Description of command			Status	FW vers.
This command determines the routing of the speech data and which device is being tested.			CEST	V3.0

[SENSe:]SIGNalling[:CSWitched]:SMS?				Short Message Service Text
Return	Description of parameters	Def. value	Def. unit	Unit ring
"<String>"	Short message received	""	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It reads the short message received.			all	V2.0

CONFigure:SIGNalling[:CSWitched]:SMS *<Text>*				Short Message Service Text
<Text>	Description of parameters	Def. value	Def. unit	Unit ring
"<String>"	Short message to be sent	"Rohde & Schwarz Short Message Service Text"	–	–
Description of command			Sig. State	FW vers.
This command defines a short message in the form of any alphanumeric string with a maximum of 160 characters.			all	V2.0

PROCedure:SIGNalling[:CSWitched][:TCH]:CHANnel *<Number>*				Traffic Channel
<Number>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 293 | 306 to 340	Number of traffic channel, GSM400	275	–	–
128 to 251	Number of traffic channel, GSM850	192	–	–
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	62	–	–
512 to 885	Number of traffic channel, GSM1800	740	–	–
512 to 810	Number of traffic channel, GSM1900	610	–	–
Description of command			Sig. State	FW vers.
This command changes the traffic channel number (and thus the frequency) for signals of the CMU while a connection is established.			CEST	≥1.15

PROCedure:SIGNalling[:CSWitched][:TCH]:TADVance *<Bit>*				Timing Advance
<Bit>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 63 bit	Timing advance for GSM850/900/1800/1900	0	bit	
0 bit to 219 bit	Timing advance for GSM400	0	bit	
Description of command			Sig. State	FW vers.
This command changes the mobile's timing while a connection is established.			CEST	≥3.05

Combined Channel/TS/PCL Change

PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:CHCCombined
<ChannelNumber>, <Timeslot>, <PCL>

<ChannelNumber>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 293 | 306 to 340	Number of traffic channel, GSM400	275	–	–
128 to 251	Number of traffic channel, GSM850	192	–	–
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	62	–	–
512 to 885	Number of traffic channel, GSM1800	740	–	–
512 to 810	Number of traffic channel, GSM1900	610	–	–
<Timeslot>>	Description of parameters	Def. value	Def. unit	Unit ring
2 to 6 | **0 to 7**	Number of timeslot with BATC setting Number of timeslot with BOTC setting	3	–	–
<PCL>	Description of parameters	Def. value	Def. unit	Unit ring
	Power of mobile phone in PCL units,			
0 to 19	GSM400/850/900	15	PCL	–
0 to 31	GSM1800	10	PCL	–
0 to 31	GSM1900	10	PCL	–

Description of command	Sig. State	FW vers.
This command controls the combined channel change, the number of the traffic channel for signals of the CMU, the timeslot for this channel and the mobile power level being changed at the same time. Thus, the command combines the three commands `PROCedure:SIGNalling[:CSWitched][:TCH]:CHANnel` *`<Number>`*, `PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot` *`<Timeslot>`*, and `PROCedure:SIGNalling[:CSWitched]:MS:PCL` *`<PCL>`* (see below). All GSM timeslots are available if the control channel mode is set to BOTC (see command `CONFigure:BSSignal:CCH:MODE` on p. 6.170). The GSM PCL levels are listed in chapter 4 (see list of tables or index).	CEST	≥1.15

PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:FHOPping:SEQuence ***<Sequence>*** Hopping

<Sequence>	Description of parameters	Def. value	Def. unit	Unit ring
A | B | C | D | **OFF**	Select hopping sequence Switch off frequency hopping	OFF	–	–

Description of command	Sig. State	FW vers.
This command selects one out of the four possible hopping sequences for the traffic channel or switches frequency hopping off. The hopping sequences are defined via `CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping`; see p. 6.172.	CEST	≥3.05

PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot ***<Timeslot>*** Timeslot

<Timeslot>	Description of parameters	Def. value	Def. unit	Unit ring
2 to 6 | **0 to 7**	Number of timeslot with BATC setting Number of timeslot with BOTC setting	3	–	–

Description of command	Sig. State	FW vers.
This command changes the traffic channel timeslot while a connection is established. All GSM timeslots are available if the control channel mode is set to BOTC (see command `CONFigure:BSSignal:CCH:MODE` on p. 6.170).	CEST	≥1.15

PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:MS:PCL *<PCL>* PCL

<PCL>	Description of parameters	Def. value	Def. unit	Unit ring
	Power of mobile phone in PCL units,			
0 to 19	GSM400/850/900	15	PCL	–
0 to 31	GSM1800	10	PCL	–
0 to 31	GSM1900	10	PCL	–

Description of command	Sig. State	FW vers.
This command commands the mobile phone to change its power control level while a connection is established. The range depends on the GSM phase of the mobile (see chapter 4).	CEST Q: all	≥1.15

PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot *<Slot_No>* Main Timeslot

<Slot_No>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Main timeslot, used for signalling	5	–	–

Description of command	Sig. State	FW vers.
This command changes the timeslot that the MS and the BS/CMU use for signalling (current value).	CEST Q: all	V3.05

Slot Configuration: Individual

PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:SCONfig:INDividual
<Enable_0>,<Enable_1>, ..., <Enable_7>, <Level_0>, ..., <Level_7>

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable downlink timeslot no. n (the MS is instructed to listen to this TS)	see below	–	–
<Level_n>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n (the CMU actually transmits a signal in this TS)	see below	dB	

Description of command	Sig. State	FW vers.
This command changes the levels in all active or inactive timeslots slots of the BS signal (current values) for the *Individual* level mode (see command `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe` on p. 6.174).: All 8 levels can be set individually. They are defined relative to the *Reference Level* set via `PROCedure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel` (see p. 6.173). The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a reference level of –85 dBm, the individual timeslot levels can be set in the range –52 dB to +75 dB, corresponding to an absolute level of –137 dBm to –10 dBm. In the default setting, slots 3 and 4 are enabled, both levels are 0 dB. By default, slot no. 3 is also the main timeslot; see `PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot` command on p. 6.167. ***Note:*** *At present no timeslots can be enabled or disabled in the CEST state so that all <Enable_n> parameters are ignored.*	CEST Q: all	V3.05

Subsystem HANDover

The subsystem *HANDover* sets the target for a forced handover of the mobile phone. The corresponding softkeys are located in the *Handover* tab in the popup menu *Connect. Control*.

STATus:HANDover:TARGet:LIST?				Destination List
Response	Description of parameters	Def. value	Def. unit	Unit ring
"GSM400MsDualBand",	Target list (4 entries at maximum):	–	–	–
"GSM850MsDualBand",		–	–	–
"GSM900MsDualBand",	All installed and enabled GSM	–	–	–
"GSM1800MsDualBand",	networks except the current network	–	–	–
"GSM1900MsDualBand"		–	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns a list of all networks that are available for a handover. The list depends on the software configuration and on the current network.			CEST	≥2.00 ≥3.01 (ext.)

CONFigure:HANDover:TARGet *<Target>*				Destination Selection
<Target>	Description of parameters	Def. value	Def. unit	Unit ring
"GSM400MsDualBand" | **"GSM850MsDualBand" |** **"GSM900MsDualBand" |** **"GSM1800MsDualBand" |** **"GSM1900MsDualBand"**	Possible target networks	see below	–	–
NONE	No handover			
Description of command			Sig. State	FW vers.
This command selects a handover target. The available targets comprise all installed and enabled GSM networks except the current network. The handover itself is started via the `PROCedure:SIGNalling[:CSWitched]:ACTion HANDover` command. If GSM400, GSM850, GSM1800, or GSM1900 is the current network and GSM900 is enabled, GSM900 is used as a default target. If GSM900 is the current network and GSM1800 is enabled, GSM1800 is the default target. Otherwise the default target is set to *NONE*.			CEST	≥2.00 ≥3.01 (ext.)

Subsystem MSSignal (Signal of Mobile Station)

The subsystem *MSSignal* configures the operating mode and the RF traffic channel signal of the MS under test. It corresponds to the tab *MS Signal* in the popup menu *Connect. Control*.

CONFigure:MSSignal:MCONtrol:MESLot *<Slot_No>*				Meas. Slot
<Slot_No>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Traffic channel timeslot number	0	–	–
Description of command			Sig. State	FW vers.
This command defines the measured timeslot of the MS signal.			≠CEST, Q: all	V3.05

CONFigure:MSSignal:CCH:PMAX[7] *<Level>* PMAX

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
	Maximum MS power in the cell,			
0 to 19	GSM400/850/900	5	PCL	–
0 to 31	GSM1800/GSM1900	0	PCL	–

Description of command	Sig. State	FW vers.
This command defines the maximum MS transmitter output power allowed in the cell. The value corresponds to the output power at which the mobile station synchronizes to the network. It is valid both for circuit-switched and for packet data mode. An overview of power control levels (PCL) in GSM is given in chapter 4 (see table or index).	≠CEST ≠TEST, Q: all	≥3.05

The output power during a call can be set by means of the following commands:

`CONFigure:MSSignal[:CSWitched][:TCH][:SSLot]:MS:PCL` (circuit switched, single slot)
`CONFigure:MSSignal[:CSWitched][:TCH]:MSLot:SCONfig` (circuit switched, multislot)
`CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONfig` (packet data, single slot)

CONFigure:MSSignal[:CSWitched]:DTX *<Mode>* DTX

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Transmission with interruption not possible	OFF	–	–
OFF	Transmission with interruption possible			

Description of command	Sig. State	FW vers.
This command permits the mobile to make use of the DTX mode *(discontinuous transmission mode)*. The status assumed by the mobile is to be determined using the command `[SENSe:]RREPorts:DTX?`. Only useful data are transferred in DTX mode; if nothing is spoken, the mobile will transmit nothing in the traffic frames.	≠CEST, Q: all	≥3.05

CONFigure:MSSignal[:CSWitched][:TCH]:TADVance *<Bit >* Timing Advance

<Bit>	Description of parameters	Def. value	Def. unit	Unit ring
0 bit to 63 bit	Timing advance for GSM850/900/1800/1900	0	bit	
0 bit to 219 bit	Timing advance for GSM400	0	bit	

Description of command	Sig. State	FW vers.
This command sets the default value for the mobile's timing.	≠CEST, Q: all	≥3.05

CONFigure:MSSignal[:CSWitched][:TCH][:SSLot]:MS:PCL *<Level>* PCL Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
	Power of mobile phone in PCL units,			
0 to 19	GSM400/850/900	15	PCL	–
0 to 31	GSM1800/1900	10	PCL	–

Description of command	Sig. State	FW vers.
This command defines the mobile power level upon registration in the network. An overview of power control levels (PCL) in GSM is given in chapter 4 (see table or index).	≠CEST, Q: all	≥3.05

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[7] In firmware versions <V3.05, this command is replaced by `CONFigure:NETWork[:MS]POWer`. This command sets the maximum MS transmitter power and the MS transmitter power during a call to the same value. It is still available for compatibility reasons.

CONFigure:MSSignal[:CSWitched][:TCH]:MSLot:SCONfig *<Enable_0>,<Enable_1>, ..., <Enable_7>, <PCL_0>, ..., <PCL_7>* Slot Configuration: Uplink

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable timeslot no. n	see below	–	–
<PCL_n>	Description of parameters	Def. value	Def. unit	Unit ring
	Power of mobile phone in timeslot no. n:			
0 to 19	GSM400/850/900	15	PCL	–
0 to 31	GSM1800/1900	10	PCL	–

Description of command	Sig. State	FW vers.
This command defines the active timeslots slots of the MS signal and the transmitter output power that the MS will use in all active slots (default values). In the default setting, only slot 3 is enabled. Slot no. 5 is also the main timeslot; see `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot` command on p. 6.173.	≠CEST, Q: all	V3.05

Subsystem BSSignal (Signal of Base Station/CMU)

The subsystem *BSSignal* configures the operating mode and the RF control and traffic channels that the CMU transmits to communicate with the MS under test. It corresponds to the tab *BS Signal* in the popup menu *Connect. Control*.

CONFigure:BSSignal:FM:DEViation *<FrequencyOffset>* Frequency Offset

<FrequencyOffset>	Description of parameters	Def. value	Def. unit	Unit ring
–100 kHz to +100 kHz	Frequency offset	0.0	Hz	

Description of command	Sig. State	FW vers.
This command determines a frequency offset for the CMU signals (CCH and TCH).	≠CEST, Q: all	≥1.15

CONFigure:BSSignal:CCH:MODE *<Mode>* Control Channel Mode

<CCHChannel>	Description of parameters	Def. value	Def. unit	Unit ring
BATC	BCCH and TCH	BATC	–	–
BOTC	BCCH or TCH			

Description of command	Sig. State	FW vers.
This command determines the BS signal configuration in the CEST state. In the BOTH setting the BCCH is switched off as soon as CEST is reached so that all 8 timeslots are available for the traffic channel (see command `CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:TIMeslot` on p. 6.172).	≠CEST, Q: all	≥3.05

CONFigure:BSSignal:CCH:CHANnel <*CCHChannel*> Control Channel

<CCHChannel>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 293 | 306 to 340	Number of traffic channel, GSM400	270	–	–
128 to 251	Number of traffic channel, GSM850	162	–	–
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	32	–	–
512 to 885	Number of traffic channel, GSM1800	735	–	–
512 to 810	Number of traffic channel, GSM1900	600	–	–

Description of command	Sig. State	FW vers.
This command determines the control channel for the CMU signals (BCCH).	SON, SOFF	≥1.15

CONFigure:BSSignal:CCH:LEVel[:ABSolute] <*Level*> Control Channel Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	Absol. level of control channel, RF1	–85	dBm	
–137 dBm to –10 dBm	Absol. level of control channel, RF2	–85	dBm	
–90 dBm to +13 dBm	Absol. level of control channel, RF3 OUT	–85	dBm	

Description of command	Sig. State	FW vers.
This command determines the level of the control channel in absolute units.	≠CEST, Q: all	≥1.15

CONFigure:BSSignal[:CSWitched][:TCH]:CHANnel <*TCHChannel*> Traffic Channel

<TCHChannel>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 293 | 306 to 340	Number of traffic channel, GSM400	275	–	–
128 to 251	Number of traffic channel, GSM850	192	–	–
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	62	–	–
512 to 885	Number of traffic channel, GSM1800	740	–	–
512 to 810	Number of traffic channel, GSM1900	610	–	–

Description of command	Sig. State	FW vers.
This command determines the number of the traffic channel.	≠CEST, Q: all	≥1.15

CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot <*Level*> Used Timeslot Level
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot <*Level*>

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–90	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–90	dBm	
–90 dBm to +13 dBm	RF3 OUT level in used timeslot	–90	dBm	

Description of command	Sig. State	FW vers.
This command determines the absolute level in the used timeslot. The value range depends on the RF output of the CMU used. See note on *Current vs. default values* on p. 6.161.	all	≥1.15

CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot *<Level>*
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot *<Level>*

Unused Timeslot Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Level in unused timeslot	see below	dB	

Description of command	Sig. State	FW vers.
This command determines the (relative) level in the unused timeslots. The level range quoted above is restricted by the condition that the absolute level (calculated from the used timeslot level and the relative level in the unused timeslots) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a default used timeslot level of –90 dBm, the unused timeslot level can be set in the range –47 dB to +80 dB, corresponding to an absolute level of –137 dBm to –10 dBm. See note on *Current vs. default values* on p. 6.161.	all	≥1.15

CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:TIMeslot *<Timeslot>*

Timeslot

<Timeslot>	Description of parameters	Def. value	Def. unit	Unit ring
2 to 6 | **0 to 7**	Number of timeslot with BATC setting Number of timeslot with BOTC setting	3	–	–

Description of command	Sig. State	FW vers.
This command determines the timeslot for the BS traffic channel. All GSM timeslots are available if the control channel mode is set to BOTC (see command `CONFigure:BSSignal:CCH:MODE` on p. 6.170).	≠CEST, Q: all	≥1.15

Edit Hopping Sequence

CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:A *<Channel>{,<Channel>}*
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:B *<Channel>{,<Channel>}*
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:C *<Channel>{,<Channel>}*
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:D *<Channel>{,<Channel>}*

<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 124, **955 to 1023 |** **OFF**	Sequence of up to 64 GSM channels, depending on the GSM band used (example: GSM900), undefined channel number	see below	–	–

Description of command	Sig. State	FW vers.
These commands define hopping sequences that supersede the four hopping sequences A to D quoted below. The sequence may consist of up to 64 arbitrary GSM channel numbers; however, a query returns each hopping sequence in ascending order. Undefined channels are set to *OFF*. The current hopping sequence can be changed during the connection, see command `PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:FHOPping:SEQuence` on p. 6.166. For GSM400, the following four default sequences are available:	≠CEST, Q: all	1.20

Sequence A:	260, 262, 265, 267, 269, 272, 274, 278, 280, 282, 285, 287, 290, 292, OFF, ... OFF
Sequence B:	159, 276, 293, OFF,...OFF
Sequence C:	307, 309, 312, 314, 316, 319, 321, 325, 327, 329, 332, 334, 337, 339, OFF, ... OFF
Sequence D:	306, 323, 340, OFF, ... OFF

For GSM850, the following four default sequences are available:	
Sequence A:	130, 134, 138, 143, 145, 149, 153, 157, 163, 167, 171, 176, 181, 185, 189, 193, 198, 202, 205, 209, 211, 215, 217, 219, 221, 227, 231, 234, 238, 242, 246, 250, OFF, ... OFF
Sequence B:	132, 135, 139, 142, 144, 148, 151, 156, 161, 164, 166, 173, 177, 179, 182, 186, OFF,...OFF
Sequence C:	195, 203, 206, 210, 213, 216, 220, 223, 226, 229, 232, 235, 239, 243, 245, 249, OFF, ... OFF
Sequence D:	128, 190, 251, OFF, ... OFF
For GSM900, the following four default sequences are available:	
Sequence A:	5, 9, 16, 23, 28, 30, 34, 39, 44, 48, 51, 54, 59, 64, 69, 73, 75, 79, 82, 86, 89, 92, 96, 98, 101, 106, 109, 113, 117, 121, OFF, ... OFF
Sequence B:	4, 12, 17, 19, 23, 25, 29, 33, 36, 41, 45, 47, 53, 61, 63, OFF,...OFF
Sequence C:	65, 68, 72, 76, 79, 81, 84, 88, 91, 93, 98, 102, 105, 112, 118, OFF, ... OFF
Sequence D:	1, 62, 124, OFF, ... OFF
For GSM1800, the following four default sequences are available:	
Sequence A:	533, 559, 568, 592, 604, 617, 631, 642, 678, 697, 722, 743, 759, 796, 811, 824, OFF, ... OFF
Sequence B:	513, 518, 527, 533, 541, 545, 553, 562, 570, 577, 585, 597, OFF,...OFF
Sequence C:	755, 761, 773, 777, 788, 796, 801, 807, 816, 824, 829, 833, 847 OFF, ... OFF
Sequence D:	512, 698, 885, OFF, ... OFF
For GSM1900, the following four default sequences are available:	
Sequence A:	533, 559, 568, 592, 604, 617, 631, 642, 678, 697, 722, 743, 759, 796, OFF, ... OFF
Sequence B:	513, 518, 527, 533, 541, 545, 553, 562, 570, 577, 585, 597, OFF,...OFF
Sequence C:	755, 761, 773, 777, 788, 796, 801, 807, OFF, ... OFF
Sequence D:	512, 660, 810, OFF, ... OFF

CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel <*Level*> Reference Level
PROCedure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel <*Level*>

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–85	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–85	dBm	
–90 dBm to +13 dBm	RF3 OUT level in used timeslot	–85	dBm	

Description of command	Sig. State	FW vers.
This command defines the reference value for the individual downlink (BS) signal levels. See command `PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:SCONfig:INDividual` on p. 6.167. See also note on *Current vs. default values* on p. 6.161.	all	≥3.05

CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot <*Slot_No*> Main Timeslot

<Slot_No>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Main timeslot, used for signalling	3	–	–

Description of command	Sig. State	FW vers.
This command defines the timeslot that the MS and the BS/CMU use for signalling (default value).	≠CEST, Q: all	V3.05

CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe *<Mode>*		Level Mode		
<Slot_No>	Description of parameters	Def. value	Def. unit	Unit ring
UUN | **IND**	Used timeslot and unused timeslot levels Individual timeslot levels	UUN	–	–
Description of command			Sig. State	FW vers.
This command determines whether the CMU uses the used/unused timeslot level scheme (two different levels) or individual levels in all timeslots.			≠CEST, Q: all	V3.05

CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:UUNused *<Enable_0>,<Enable_1>, ..., <Enable_7*		Slot Configuration: Used/Unused		
<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable timeslot no. n	see below	–	–
Description of command			Sig. State	FW vers.
This command defines the active timeslots slots of the BS signal (default values) and implicitly defines the levels for the *Used/Unused* level mode (see command `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe` on p. 6.174). • The level in all enabled timeslots is given by the *Used Timeslot Level* defined via `CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot` (see p. 6.172). • The level in all disabled timeslots is given by the *Unused Timeslot Level* def. via `CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot` (see p. 6.171). In the default setting, timeslots 0, 2, and 5 are enabled. By default, slot no. 5 is also the main timeslot; see command `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot` on p. 6.173. ***Note:*** *The <Enable_n> parameters also apply in individual level mode; they overwrite the parameters in the* `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:INDividual` command.			≠CEST, Q: all	V3.05

CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:INDividual Slot Configuration

Individual***<Enable_0>,<Enable_1>, ..., <Enable_7>, <Level_0>, ..., <Level_7>***

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable downlink timeslot no. n (the MS is instructed to listen to this TS)	see below	–	–
<Level_n>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n (the CMU actually transmits a signal in this TS)	see below	dB	

Description of command	Sig. State	FW vers.
This command defines the active timeslots slots of the BS signal (default values) and the levels for the *Individual* level mode (see command `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe` on p. 6.174). All 8 timeslots can be enabled and their levels can be set individually. They are defined relative to the *Reference Level* set via `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel` (see p. 6.173). The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a reference level of –85 dBm, the individual timeslot levels can be set in the range –52 dB to +75 dB, corresponding to an absolute level of –137 dBm to –10 dBm. In the default setting, slots 3 and 4 are enabled, both levels are 0 dB. By default, slot no. 3 is also the main timeslot; see `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot` command on p. 6.173. ***Note:*** *The <Enable_n> parameters also apply in used/unused level mode; they overwrite the parameters in the* `CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:UUNused` *command.*	≠CEST, Q: all	V3.05

Subsystem NETWork

The subsystem *NETWork* defines various parameters of the network that the CMU reports to the mobile station. The subsystem corresponds to the popup menu *Network* in the menu group *Connect. Control*.

CONFigure:NETWork:BAList *<Channel>* {,*<Channel>*} BA List

<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
0 to1023 | **OFF**	BCCH ch. numbers BA list switched off	260,330,OFF,...,OFF (GSM400) 130,250,OFF,...,OFF (GSM850) 10,120,OFF,...,OFF (GSM900) 520,620,OFF,... (GSM1800) 550,700,OFF,... (GSM1900)	–	–

Description of command	Sig. State	FW vers.
This command generates the list of up to 16 used channels in the adjacent cells (BA list, *BCCH allocation list)*. In the query format, the command returns the channel numbers in the BA list.	≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:AOCHarge:ENABle *<Enable>* Advice of Charge
CONFigure:NETWork[:CSWitched]:AOCHarge *<Value1>, <Value2> ... , <Value7>*

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch on or off data for advice of charge	ON	–	–
<Value n> ...	Description of parameters	Def. value	Def. unit	Unit ring
0 to 8191	Values 1 to 7 for calculating the charges	0,0,0,0,0,0,0	–	–
Description of command			Sig. State	FW vers.
The seven numbers denote the following:	Units per interval Seconds / time interval Scaling factor Unit increment Units per data interval Segments / data interval Initial secs / t interval		≠CEST, Q: all	V1.15

CONFigure:NETWork[:CSWitched]:SOFFset *<Offset>* Slot Offset

<Code>	Description of parameters	Def. value	Def. unit	Unit ring
–7 to +7	Slot Offset	0	–	–
Description of command			Sig. State	FW vers.
This command defines defines the DL timeslot that the mobile is to loop back to the uplink main timeslot.			≠CEST, Q: all	V3.05

Subsystem NETWork:IDENtity

The subsystem *NETWork:IDENtity* defines the identity of the mobile radio network. The subsystem corresponds to the table section *Network Identity* in the popup menu *Network*.

CONFigure:NETWork:IDENtity:NCC *<Code>* NCC

<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Color code of mobile network	0	–	–
Description of command			Sig. State	FW vers.
This command defines the color code of the network *(NCC = network color)* for the signals of the measuring instrument.			SOFF, SON Q: all	≥1.15

CONFigure:NETWork:IDENtity:MCC *<Code>* MCC

<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 999	Mobile country code	001	–	–
Description of command			Sig. State	FW vers.
This command defines the mobile country code.			SOFF, SON Q: all	V1.15

CONFigure:NETWork:IDENtity:MNC <*Code*>				MNC
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 99	Mobile network code	01	–	–
Description of command			Sig. State	FW vers.
This command defines the mobile network code for the signals of the measuring instrument.			SOFF, SON Q: all	≥1.15

CONFigure:NETWork:IDENtity:BCC <*Code*>				BCC
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Color code of measuring instrument	1	–	–
Description of command			Sig. State	FW vers.
This command defines the color code of the BTS *(base transceiver station color code, BTS color code = BCC).*			SOFF, SON Q: all	≥1.15

CONFigure:NETWork:IDENtity:LAC <*Code*>				Location Area
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 65533 and 65535	Location area code	1	–	–
Description of command			Sig. State	FW vers.
This command defines the location area code.			SOFF, SON Q: all	≥1.15

Subsystem NETWork:SYSTem (System Parameters)

The subsystem *NETWork:System* determines system parameters for the radio connection. The subsystem corresponds to the table section *System Parameters* in the popup menu *Network*.

CONFigure:NETWork:SYSTem:CACCess <*Mode*>				Cell Access
Mode>	Description of parameters	Def. value	Def. unit	Unit ring
BARRed | **NBARred**	Radio cell disabled for all mobiles Radio cell accessible	NBARred	–	–
Description of command			Sig. State	FW vers.
This command enables or disables the radio cell for mobiles.			SOFF, SON Q: all	≥1.15

CONFigure:NETWork:SYSTem:BSAGblksres <*Blocks*>				Number of Reserved Blocks
<Blocks>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Number of reserved blocks in the BCCH for access channel	0	–	–
Description of command			Sig. State	FW vers.
This command determines the number of data blocks to be reserved for the granted access *(access grant channel = AGC)* within the BCCH *(basic services access grant blocks reserved).*			≠CEST, Q: all	≥1.15

CONFigure:NETWork:SYSTem:BSPamfrms *<Frames>*		Paging Request Interval		
<Frames>	Description of parameters	Def. value	Def. unit	Unit ring
2 to 9	Interval between two paging requests	2		–

Description of command	Sig. State	FW vers.
This command defines the interval between two paging requests in a multiframe in frames *(basic services paging blocks available per multiframe)*.	≠CEST, Q: all	≥1.15

CONFigure:NETWork:SYSTem:BSPReorganis <MODE>		Paging Reorganisation		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Paging reorganization on/off	OFF	–	–

Description of command	Sig. State	FW vers.
This command swithches the paging reorganization parameter on and off. In the *OFF* state, the mobile is prevented from switching to the idle mode.	≠CEST, Q: all	≥V2.00

CONFigure:NETWork:SYSTem:ACLass <*Code*>		Access Class		
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 2^{16}–1 (16 bit value)	Access classes (0 to 15) barred from network access	0	–	–

Description of command	Sig. State	FW vers.
This command prevents mobile stations of definite access classes from making access attempts when the CMU starts transmitting its BCCH channel. The 16 bit value is written to the *RACH Control Parameter* information element and broadcast to the MS. Each true bit (no. 0 to 15, starting with the least significant bit) means that the corresponding access class is barred. Barring the network access is useful to establish an off-air connection to a mobile station with a particular access class while preventing other mobiles from making access attempts. The feature is not available in manual control. The default value (no access class barred) is restored each time the CMU is rebooted.	SON, SOFF Q: all	V3.05

Subsystem NETWork[:CSWitched]:SMODe (Type of Signalling)

The subsystem *NETWork[:CSWitched]:SMODe* defines signalling parameters concerning the function of the mobile. The subsystem corresponds to the table section *Signalling Modes* in the popup menu *Network*.

CONFigure:NETWork[:CSWitched]:SMODe:LOCupdate *<Mode>*		Location Update		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALWays | **AUTO**	Location update each time the mobile is switched on Only if necessary	ALW	–	–

Description of command	Sig. State	FW vers.
This command determines in which cases the mobile performs a location update.	≠CEST, Q: all	V1.20

CONFigure:NETWork[:CSWitched]:SMODe:PCHange *<Mode>*		Power Change Mode		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
FAST | **SLOW**	Fast power change Slow power change	FAST	–	–

Description of command	Sig. State	FW vers.
This command determines the speed of power control on the mobile phone. The slow power change is controlled via SACCH *(slow associated control channel)*, the fast power change via FACCH *(fast associated control channel)*.	≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:SMODe:SCHannel *<Channel>*		Signalling Channel		
<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
SDCCh | **FACCh |** **NONE**	Signalling via *stand-alone dedicated control channel* Signalling via *fast associated control channel* No signalling	FACCh	–	–

Description of command	Sig. State	FW vers.
This command determines the control channel type that the CMU uses for signalling.	≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic *<Mode>*				Traffic
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
FRV1 | **FRV2 |** **HRV1 |** **FD48 |** **FD96 |** **FD14 |** **HD24 |** **HD48 |** **C1TM |** **...** **C4TM |** **MC1Tm |** **...** **MC4Tm**	Full-rate coding, Full Rate Version 1 Full Rate Version 2 (Enhanced Full Rate) Half-rate coding, Half Rate Version 1 Full Rate Data 4800 Baud Full Rate Data 9600 Baud Full Rate Data 14400 Baud Half Rate Data 2400 Baud Half Rate Data 4800 Baud GPRS coding scheme 1 (CS-1) ... GPRS coding scheme 4 (CS-4) EGPRS modulation and coding scheme 1 (MCS-1) ... EGPRS modulation and coding scheme 9 (MCS-9)	FRV1	–	–

Description of command	Sig. State	FW vers.
This command determines the speech coding and voice transmission in the traffic channels (full-rate channel, half-rate channel, packet data channel etc.). The GPRS and EGPRS coding schemes are supported for FW versions ≥3.0.	≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:SMODe:BITStream <*Mode*>
PROCedure:NETWork[:CSWitched]:SMODe:BITStream <*Mode*>

Bit Stream

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ECHO |	Loop back in the CMU with delay	ECHO	–	–
LOOP |	Loop back in the CMU with minimal delay			
PR9 |	2^9-1 PSR bit pattern			
PR11 |	2^{11}-1 PSR bit pattern			
PR15 |	2^{15}-1 PSR bit pattern			
PR16 |	2^{16}-1 PSR bit pattern			
HANDset |	Handset			
HLOW	Handset Low			
CCAL |	Codec Cal			
ECAL |	Encoder Cal			
DCAL	Decoder Cal			

Description of command	Sig. State	FW vers.
This command determines the type of data transmitted in the traffic channel. For BER measurements, one of the pseudo random sequences (PSR) must be used. See note on *Current vs. default values* on p. 6.161.	all	≥3.05

CONFigure:NETWork[:CSWitched]:SMODe:LCOMmand <*Mode*>

Loop Command

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ENABle |	The CMU sends "Close Loop" every time a connection is established	BER	–	–
DISable |	The CMU never sends „Close Loop" → Mobile never sends back			
BER	Loop is closed for BER measurements only			

Description of command	Sig. State	FW vers.
This command determines in which cases the open/close loop command is sent to the mobile. Closing of the loop causes the mobile to send back the bits received.	≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:SMODe:STIMe <*Mode*>
PROCedure:NETWork[:CSWitched]:SMODe:STIMe <*Mode*>

Starting Time

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 600 Frames	Starting time, number of frames transferred	0	–	–

Description of command	Sig. State	FW vers.
The starting time is used with channel, timeslot and fast power change. The value 0 means that no start time is used. See note on *Current vs. default values* on p. 6.161.	all	≥1.15

CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MNC <*MNC*> **CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MCC <MCC>** **CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MSIN <*MSIN*>**					Default IMSI: Mobile Network Code Mobile Country Code Mobile Subscriber Id. No
Parameter	***Value ranges***	Description of parameters	Def. value	Def. unit	Unit ring
MCC	**0 to 999**	Mobile Country Code	001	–	–
MNC	**0 to 99**	Mobile Network Code	01	–	
MSIN	**"0" to "9999999999"**	Mobile Subscriber Id. No.	"1000000095"	–	
Description of command				Sig. State	FW vers.
This command defines an international mobile subscriber identity *(IMSI)* which serves as the default setting for a call to the mobile. It consists of the mobile country code (*MCC)*, mobile network code (*MNC)* and the mobile subscriber identification no. (*MSIN)*. MSIN is a string variable and must be entered in quotation marks (' or "). The values defined here can be overwritten by the mobile parameters. The default value quoted above for MSIN applies to phase II mobiles. The default value for phase I mobiles is "1000000000".				≠CEST, Q: all	≥1.15

Subsystem NETWork[:CSWitched]:REQuest (Requested Mobile Data)

The subsystem *NETWork[:CSWitched]:REQuest* determines the signalling parameters of the mobile to be requested. The subsystem corresponds to the table section *Requested Mobile Data* in the popup menu *Network*.

CONFigure:NETWork[:CSWitched]:REQuest:IMSI <*Mode*>				IMSI Request
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	IMSI requested No request	ON	–	–
Description of command			Sig. State	FW vers.
This command determines whether the international mobile subscriber identity of the connected mobile phone is requested during *location update*, *call to mobile*, *call from mobile*, or *SMS transfer.*			≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:REQuest:IMEI <*Mode*>				IMEI Request
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	IMEI requested No request	ON	–	–
Description of command			Sig. State	FW vers.
This command determines whether the international mobile station equipment identity (IMEI) of the connected mobile is requested during *location update*, *call to mobile*, *call from mobile*, or *SMS transfer.*			≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:REQuest: AUTHenticate *<Mode>*				Authentication Request
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Authentication request No request	OFF	–	–
Description of command			Sig. State	FW vers.
This command determines whether an authentication request of the connected mobile is made during *location update*, *call to mobile*, *call from mobile*, or *SMS transfer*.			≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:REQuest:HANDover *<Mode>*				Handover Request
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Handover request No handover request	ON	–	–
Description of command			Sig. State	FW vers.
This command determines whether the capability to perform a handover is requested on the connected mobile during *location update*, *call to mobile*, *call from mobile*, or *SMS transfer*.			≠CEST, Q: all	≥1.15

Subsystem NETWork[:CSWitched]:TIMeout

The subsystem *NETWork[:CSWitched]:TIMeout* defines timeouts for aborting an unused radio link or an unsuccessful call to the mobile. The subsystem corresponds to the table section *Timeouts* in the popup menu *Network*.

CONFigure:NETWork[:CSWitched]:TIMeout:RLINk[:MOBile] *<Time>*				Radiolink Timeout Mobile
<Time>	Description of parameters	Def. value	Def. unit	Unit ring
4 to 64	Number of missing SACCH blocks (the step size is 4)	24	–	–
Description of command			Sig. State	FW vers.
This command defines the maximum number of SACCH blocks which may be missing before a **mobile phone** considers the radio link to be interrupted *(radio link timeout)*			≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:TIMeout:RLINk:TESTset *<Time>*				Radiolink Timeout Testset
<Time>	Description of parameters	Def. value	Def. unit	Unit ring
4 to 64 | **OFF**	Number of missing SACCH blocks (the step size is 1) Monitoring of radio link is switched off (ie there is no Sync. Lost in the case of missing SACCH blocks)	24	–	–
Description of command			Sig. State	FW vers.
This command determines the maximum number of SACCH blocks which may be missing before the CMU considers the radio link to be interrupted *(radio link timeout for test set)*.			≠CEST, Q: all	≥1.15

CONFigure:NETWork[:CSWitched]:TIMeout:MTC *<Time>*				MTC Timeout
<Time>	Description of parameters	Def. value	Def. unit	Unit ring
0 s to 60 s **OFF**	Time limit for call to mobile No time limit (unlimited ringing)	10	s	TIME
Description of command			Sig. State	FW vers.
This command determines the maximum dialing time until the mobile accepts the call *(mobile terminated call timeout)*; after this time, the attempted call setup is aborted. In the setting OFF, ringing is possible for an unlimited period of time.			≠CEST, Q: all	≥1.15

Subsystem IOConnector (External Attenuation at the Connectors)

The subsystem for input and output configures the input and output connectors. The subsystem corresponds to the tab *RF* ⊸, in the popup menu *Connect. Control*.

INPut[:STATe] *<State>*				RF Input
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1	Connector RF1 used as input	RF2	–	–
RF2	Connector RF2 used as input			
RF4	Connector RF4 IN used as input			
Description of command			Sig. State	FW vers.
This command determines the connector to be used for RF input signals. The bidirectional connectors RF1 and RF2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.			all	≥1.15

OUTPut[:STATe] *<State>*				RF Output
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1	Connector RF1 used as output	RF2	–	–
RF2	Connector RF2 used as output			
RF3	Connector RF3 OUT used as output			
Description of command			Sig. State	FW vers.
This command determines the connector to be used for RF output signals. The bidirectional connectors RF1 and RF2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`). Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.			all	≥1.15

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >*
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >*

Ext. Att. Input

<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2	0	dB	Ratio
–90 dB to +90 dB	Ext. attenuation at RF 4 IN			

Description of command	Sig. State	FW vers.
This command assigns an external attenuation value to one of the inputs defined before (see command `INPut:STATe`).	all	≥1.15

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>*
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>*

Ext. Att. Output

<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2	0	dB	Ratio
–90 dB to +90 dB	Ext. attenuation at RF3 OUT			

Description of command	Sig. State	FW vers.
This command assigns an external attenuation value to one of the outputs defined before (see command `OUTPut:STATe`).	all	≥1.15

ROUTe:SPENcoder[:INPut] *<Source>*

Speech Encoder

<Source>	Description of parameters	Def. value	Def. unit	Unit ring
HANDset |	Handset is used as source	HAND	–	–
GENerator	AF generator is used as source			

Description of command	Sig. State	FW vers.
This command determines the input source that feeds the CMU speech encoder (option CMU-B52).	all	2.00

ROUTe:SPDecoder[:OUTPut] *<Destination>*

Speech Decoder

<Destination>	Description of parameters	Def. value	Def. unit	Unit ring
HANDset |	Speech decoder output routed to the handset	HAND	–	–
ANALyzer |	Speech dec. output routed to primary AF analyzer			
ANA2 |	Speech dec. output routed to secondary AF analyzer			
ABOTh	Speech dec. output routed to both AF analyzers			

Description of command	Sig. State	FW vers.
This command routes the CMU speech decoder output (option CMU-B52). The ANA2 and ABOTh settings are provided in firmware versions ≥3.05.	all	2.00

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connect. Control*.

<table>
<tr><td colspan="3">SOURce:DM:CLOCk:STATe <i><Mode></i></td><td colspan="2">REF OUT 2 on/off</td></tr>
<tr><td><i><Mode></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>ON | OFF</td><td>Switching the system clock frequency on/off</td><td>OFF</td><td>–</td><td>–</td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command switches the system clock frequency at output <i>REF OUT 2</i> on or off.</td><td>SOFF
Q: all</td><td>≥1.15</td></tr>
</table>

<table>
<tr><td colspan="3">SOURce:DM:CLOCk:FREQuency <i><Frequency></i></td><td colspan="2">REF OUT 2</td></tr>
<tr><td><i><Frequency></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>1.2190 MHz to 39.000 MHz</td><td>Input value for system clock frequency</td><td>13.000</td><td>MHz</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command defines the system clock frequency applied to output <i>REF OUT 2</i>. The frequency entered is rounded to one of the following discrete values:
39.000 MHz, 19.500 MHz, 13.000 MHz, 9.750 MHz, 7.800 MHz, 6.500 MHz, 5.571 MHz,
4.875 MHz, 4.333 MHz, 3.900 MHz, 3.545 MHz, 3.250 MHz, 3.000 MHz, 2.786 MHz,
2.600 MHz, 2.438 MHz, 2.294 MHz, 2.166 MHz, 2.053 MHz, 1.950 MHz, 1.857 MHz,
1.773 MHz, 1.696 MHz, 1.625 MHz, 1.560 MHz, 1.500 MHz, 1.444 MHz, 1.393 MHz,
1.349 MHz, 1.300 MHz, 1.258 MHz, 1.219 MHz</td><td>SOFF
Q: all</td><td>≥1.15</td></tr>
</table>

RREPorts

The subsystem *RREPorts* contains the commands for requesting the receiver report of the mobile. Together with *NETWork[:MS]* the subsystem corresponds to the softkey *MS Rcv. Reports* in the main menu *GSMxxx-MS Overview*. The receiver characteristics do not really represent a measured value, since the values are automatically transmitted during signalling.

<table>
<tr><td colspan="3">[SENSe:]RREPorts:RXLevel?</td><td colspan="2">RX Level</td></tr>
<tr><td><i>Return</i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>0 to 63</td><td>Receiver level on mobile phone</td><td>NAN</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query. It outputs the receiver level that the mobile reports to the CMU, expressed in levels without dimension (see chapter 4).</td><td>CEST</td><td>≥1.15</td></tr>
</table>

<table>
<tr><td colspan="3">[SENSe:]RREPorts:RXQuality?</td><td colspan="2">RX Quality</td></tr>
<tr><td><i>Return</i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>0 to 7</td><td>Received signal quality on mobile</td><td>NAN</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query. It outputs the received signal quality that the mobile reports to the CMU, expressed in quality levels without dimension (see chapter 4).</td><td>CEST</td><td>≥1.15</td></tr>
</table>

[SENSe:]RREPorts:RPCL? Reported PCL

Return	Description of parameters	Def. value	Def. unit	Unit ring
	Reported power of mobile phone in PCL units,			
0 to 19	GSM400/850/900	NAN	PCL	–
0 to 31	GSM1800	NAN	PCL	–
0 to 31	GSM1900	NAN	PCL	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the transmitter output power in PCL units that the MS reports to the network/CMU.	CEST	≥3.05

[SENSe:]RREPorts:NCELl? RX Level in Neighbor Cells

Return	Description of parameters	Def. value	Def. unit	Unit ring
0 to 124 | 955 to 1023,	Channel numbers of the 6 neighbor cells	NAN,	–	–
0 to 63 | NAN	RX Level in neighbor cells	NAN		

Description of command	Sig. State	FW vers.
This command is always a query. It returns the channel number and the signal level for six neighbor channels (see command `[SENSe:]RREPorts:RXLevel?` and chapter 4). The output list consists of 6 pairs of channels and corresponding RX Levels, separated by commas. The channel numbers depend on the GSM band (the parameter list quoted above is valid for GSM900), see chapter 4.	CEST	≥1.15

[SENSe:]RREPorts:DTX? DTX

Return	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Mobile phone transmits with interruption	NAN	–	–
OFF	Mobile phone transmits without interruption			

Description of command	Sig. State	FW vers.
This command is always a query and returns the DTX mode *(discontinuous transmission mode)* currently used by the mobile phone.	CEST	≥1.15

[SENSe:]RREPorts:COUNt? Number of Measurement Reports

Return	Description of parameters	Def. value	Def. unit	Unit ring
0 to n	Number of measurement reports received	0	–	–

Description of command	Sig. State	FW vers.
This command is always a query and returns the number of receiver reports transmitted since the connection was established. According to GSM specifications, a receiver report is transmitted every 4 multiframes.	CEST	≥2.00

MSSinfo
(Signalling information of mobile phone)

The subsystem *MSSinfo* contains the commands for querying the parameters of the mobile. The subsystem corresponds to the *Signalling Info* output table in the main menu *GSMxxx-MS Overview*. The mobile parameters do not actually represent a measured value, they are provided by the mobile phone during location update.

[SENSe:]MSSinfo:IMSI:MCC? **[SENSe:]MSSinfo:IMSI:MNC?** **[SENSe:]MSSinfo:IMSI:MSIN?**					MCC MNC MSIN
Returned values	***Value ranges***	Description of parameters	Def. value	Def. unit	Unit ring
MCC	0 to 999	Mobile Country Code	NAN	–	–
MNC	0 to 99	Mobile Network Code	NAN	–	
MSIN	"0" to "9999999999"	Mobile Subscriber Id. No.	"" (empty string)	–	
Description of command				Sig. State	FW vers.
These commands are always queries and return the international mobile subscriber identification code (IMSI) of the mobile. It consists of the mobile country code (*MCC)*, the mobile network code (*MNC)* and the mobile subscriber identification no. (*MSIN)*.				SYNC CEST	≥1.15

[SENSe:]MSSinfo:IMEI:FAC? **[SENSe:]MSSinfo:IMEI:TAC?** **[SENSe:]MSSinfo:IMEI:SNR?** **[SENSe:]MSSinfo:IMEI:SVN?**		Intern. mobile station equipment id.:			FAC TAC SNR SVN
Returned values	***Value ranges***	Description of parameters	Def. value	Def. unit	Unit ring
TAC	**6-digit**	Type approval code	NAN	–	–
FAC	**2-digit**	Final assembly code	NAN	–	
SNR	**6-digit**	Serial number	NAN	–	
SVN	**1 | 2-digit**	Software version number	NAN	–	
Description of command				Sig. State	FW vers.
These commands are always queries and return the international mobile station equipment identity (IMEI) of the mobile phone. It consists of a type approval code (*TCC*), the final assembly code (*FAC*), the serial number (*SNR*) and the software version number (*SVR*).				SYNC CEST	≥1.15

[SENSe:]MSSinfo:REVision?				MS Rev. Level
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
PH1 | **PH2 |** **PH2P**	Phase 1 Phase 2 Phase 2+	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns the output (GSM phase) of the mobile.			SYNC CEST	≥1.15

[SENSe:]MSSinfo:DNUMber? Dialled Number

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
"Max. 20-digit"	Dialed number	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query and returns the number dialed at the mobile.	CEST	≥1.15

[SENSe:]MSSinfo:TRAFfic? Traffic Mode

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
FRV1 |	Full-rate coding, Full Rate Version 1	NAN	–	–
FRV2 |	Full Rate Version 2 (Enhanced Full Rate)			
HRV1 |	Half-rate coding, Half Rate Version 1			
FD48 |	Full Rate Data 4800 Baud			
FD96 |	Full Rate Data 9600 Baud			
FD14 |	Full Rate Data 14400 Baud			
HD24 |	Half Rate Data 2400 Baud			
HD48 |	Half Rate Data 4800 Baud			
C1TM to C4TM |	Coding scheme 1 to 4 for GPRS			
MC1T to MC9T	Modulation and coding scheme 1 to 9 for EGPRS			

Description of command	Sig. State	FW vers.
This command is always a query and returns the speech coding and transfer in the traffic channel (full-rate channel, half-rate channel, full-rate channel with variable transfer rate).	CEST	≥1.15

[SENSe:]MSSinfo:POWer:CLASs? Power Class

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 5	Power class of mobile	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query and returns the power class of the mobile.	SYNC CEST	≥1.15

[SENSe:]MSSinfo:MSCLass:CSWitched? Multislot Class

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 29	Multislot class of mobile	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query and returns the multislot class of the mobile while it operates in circuit switched mode.	SYNC CEST	≥3.05

Options and Extensions

The features described in this section require the installation of additional software options; for a complete list of deliverable options refer to the data sheet.

GPRS Signalling (with Option CMU-K42)

The remote-control commands presented in this section control the setup and release of a TBF connection, configure the MS and BS Signals and define the network parameters for packet data services. They correspond to the settings in the *Connect. Control* popup menu that are related to packet data services.

Note 1: Current vs. default values

Some parameters of the CMU can be assigned two independent values: The default *value is used to set up a connection; it can be modified in the signalling states* Signal Off, Idle *and* Attached. *The current value during the call (signalling state TBF Established) can still be changed, however, modifying this current value does not alter the default value. An example for such a double parameter in packet data mode is the bit stream.*

Default values are set with a `CONFigure ...` *command, current values are set with the corresponding* `PROCedure ...` *command.*

Note 2: Receiver Quality measurements

Several additional commands have been introduced for Receiver Quality measurements on packet-data (GPRS) channels. These commands contain the `PDATa` *keyword but are described in section* Receiver Quality *on p. 6.144 ff. for systematic reasons.*

Signalling – Subsystem SIGNalling:PDATa

The subsystem *SIGNalling:PDATa* controls the connection between the CMU and the MS under test and changes the test mode parameters while a GPRS TBF connection is established (current parameters). In manual control, these functions are distributed over the different *Signalling* tabs (for different signalling states, see command `PROCedure: SIGNalling:PDATa:ACTion`) and the *MS Signal, BS Signal* and *Network* tabs in the popup menu *Connect. Control*.

PROCedure:SIGNalling:PDATa:ACTion *<Action>*		GPRS Signalling Control		
<Action>	Description of parameters	Def. value	Def. unit	Unit ring
SOFF | **SON |** **CTMA |** **CTMB |** **CRS |** **CDLonly |** **DISConnect**	Switch off BCCH signal *(signal off)* Switch on BCCH signal *(signal on)* Connect Test Mode A Connect Test Mode B Connect Reduced Signalling/sync. mode Connect Downlink only Disconnect	–	–	–
Description of command			Sig. State	FW vers.
This command has no query form. It changes between the different packet data signalling states of the CMU. The current state can be queried via `SIGN:PDAT:STAT?`			See below	V3.05

Important Note: ***Signalling States and Local to Remote Switchover***

The default signalling state of the CMU in remote control is SOFF (see Fig. 6-2 below). This state is automatically reached on switchover from manual to remote control; an existing connection to the MS under test is dropped.

To suspend this default behavior of the CMU, the base system command `SYSTem:GTRM:COMP` has been introduced. `SYSTem:GTRM:COMP OFF` prevents the instrument from changing the signalling state local to remote switchover. In particular, an existing connection is maintained. The default behavior of the CMU is restored each time the instrument is rebooted. For more information see the documentation of the base system commands in the CMU manual.

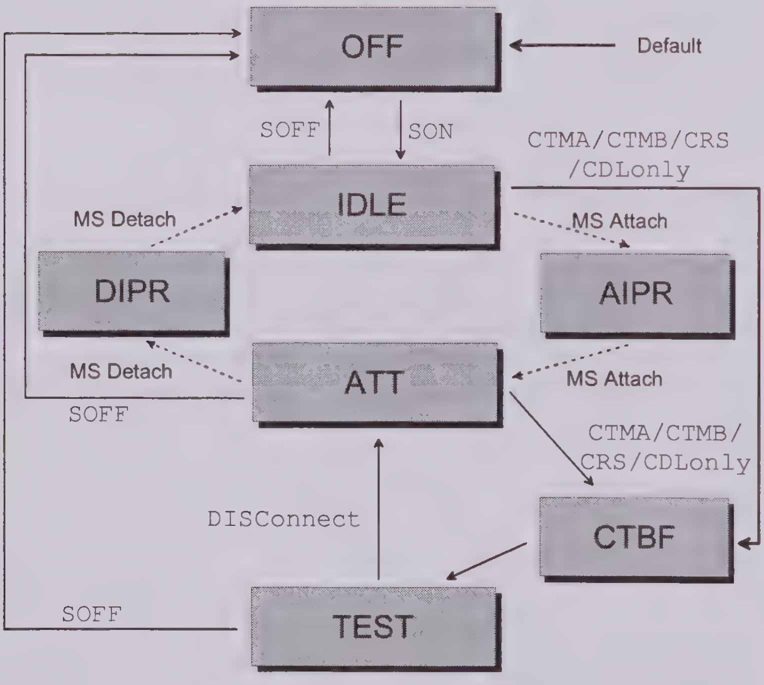

Fig. 6-2 GPRS signalling states of the CMU and transitions

Signalling states (see also command `[SENSe:]SIGNalling:PDATa:STATe?` below):

OFF	Signal Off	AIPR	Attach in Progress
IDLE	Idle	CTBF	Connecting TBF
ATT	Attached	TEST	TBF Established
RAUP	Routing area update in progress	DIPR	Detach in Progress

Actions:	*initiated from the CMU:*	*initiated from the mobile phone:*	
	See description of command	MS Attach	MS initiates GPRS-attach
	`PROC:SIGN:PDAT:ACT`	MS Detach	MS initiates GPRS-detach

Further transitions between the signalling states (not shown in Fig. 6-2) may occur, e.g. in case of errors.

[SENSe:]SIGNalling:PDATa:STATe? GPRS Signalling State

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	CMU transmits no control channel signal	OFF	–	–
IDLE |	No GPRS-attach performed yet			
ATT |	GPRS-attach succeeded			
RAUP |	Routing area update in progress			
AIPR |	GPRS-attach is currently being performed			
CTBF |	CMU attempts a TBF connection			
TEST |	TBF connection established			
DIPR	GPRS-detach is currently being performed			
Description of command			Sig. State	FW vers.
This command is always a query. It returns the current GPRS signalling state.			all	V3.01

[SENSe:]SIGNalling:PDATa:SERVice? Service Selection

Return	Description of parameters	Def. value	Def. unit	Unit ring
TMA |	Test Mode A	INV	–	–
TMB |	Test Mode B			
RSIG	Reduced Signalling/sync. mode			
DLON	Downlink only			
Description of command			Sig. State	FW vers.
This command is always a query. It returns the current GPRS service. The different test modes are accessed via `PROCedure:SIGNalling:PDATa:ACTion` (see p. 6.190).			TEST	V3.05

PROCedure:SIGNalling:PDATa[:TCH]:MSLot:BS:SCONfig Downlink Slot Configuration
<Enable_0>,..., <Enable_7>, <Level_0>,... <Level_7>

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable downlink timeslot no. n (the MS is instructed to listen to this TS)	see below	–	–
<Level_n>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n (the CMU actually transmits a signal in this TS)	see below	dB	–

Description of command	Sig. State	FW vers.
This command changes the slot configuration and the RF levels that the CMU uses in test mode (current parameters). All levels are relative to the reference level queried via `[SENSe:]BSSignal:PDATa[:TCH]:MSLot:RLEVel?` (see p. 6.193). The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a reference level of –85 dBm, the individual timeslot levels can be set in the range –52 dB to +75 dB, corresponding to an absolute level of –137 dBm to –10 dBm. In the default setting, slots 3 and 4 are enabled, both levels are 0 dB. By default, slot no. 3 is also the main timeslot; see `PROCedure:SIGNalling:PDATa[:TCH]:MSLot:MTIMeslot` command on p. 6.191.	TEST, Q: all	V3.05

Subsystem MSSignal:PDATa (RF Signal of MS under Test)

The subsystem *MSSignal:PDATa* configures the RF signal that the MS under test is to transmit in GPRS test mode. It corresponds to the *Packet Data* section in the *MS Signal* tab of the popup menu *Connect. Control*.

CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONfig Uplink Slot Configuration
<Enable_0>,..., <Enable_7>, <Gamma_0>,... <Gamma_7>

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable uplink timeslot no. n	n = 3: ON	–	–
<Gamma_n>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 31	Power control parameter Γ_{CH} in timeslot no. n	3	–	–

Description of command	Sig. State	FW vers.
This command defines the slot configuration and the channel-specific power control parameters Γ_{CH} that the MS is to use in test mode (default parameters). In the default setting, In the default setting, only slot 3 is enabled. Slot no. 3 is also the main timeslot; see `CONFigure:BSSignal:PDATa[:TCH]:MSLot:MTIMeslot` command on p. 6.193.	≠TEST, Q: all	V3.05

Subsystem BSSignal:PDATa (RF Signal of Base Station/CMU)

The subsystem *BSSignal:PDATa* configures the RF signal that the CMU transmits in packet data transfer mode. It corresponds to the *Packet Data* section in the *BS Signal* tab of the popup menu *Connect. Control*.

CONFigure:BSSignal:PDATa[:TCH]:MSLot:PZERo *<P0>* P0 Parameter

<P0>	Description of parameter	Def. value	Def. unit	Unit ring
0 dB to 31 dB	Value of P0	5	dB	–

Description of command	Sig. State	FW vers.
This command defines the downlink power control parameter P0.	≠TEST, Q: all	V3.05

CONFigure:BSSignal:PDATa[:TCH]:MSLot:CHANnel *<Number>* RF Channel

<Number>	Description of parameters	Def. value	Def. unit	Unit ring
259 to 293 | 306 to 340	Number of traffic channel, GSM400	275	–	–
128 to 251	Number of traffic channel, GSM850	192	–	–
0 to 124 | 955 to 1023	Number of traffic channel, GSM900	62	–	–
512 to 885	Number of traffic channel, GSM1800	740	–	–
512 to 810	Number of traffic channel, GSM1900	610	–	–

Description of command	Sig. State	FW vers.
This command changes the RF channel that the CMU shall use for data transfer once it is in test mode (default parameter).	≠TEST, Q: all	V3.05

[SENSe:]BSSignal:PDATa[:TCH]:MSLot:RLEVel? *<Level>* Reference Level

<Level>	Description of parameter	Def. value	Def. unit	Unit ring
–116 dBm to –85 dBm	Reference level for all downlink channels	–90	dBm	

Description of command	Sig. State	FW vers.
This command is always a query. It returns the reference level for all downlink *(BS Signal)* channels, calculated according to *RLEVel = –85 dB – PZERo*. Both the current and the default levels in all downlink timeslots are defined relative to the reference level (see commands `PROCedure:SIGNalling:PDATa[:TCH]:MSLot:BS:SCONfig` and `CONFigure:BSSignal:PDATa[:TCH]:MSLot:SCONfig`).	all	V3.05

CONFigure:BSSignal:PDATa[:TCH]:MSLot:MTIMeslot *<Number>* Main Timeslot

<Number>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Main timeslot	5	–	–

Description of command	Sig. State	FW vers.
This command changes the main timeslot that the CMU uses for signalling (default parameter).	≠TEST, Q: all	V3.05

CONFigure:BSSignal:PDATa[:TCH]:MSLot:SCONfig Downlink Slot Configuration
<Enable_0>,..., <Enable_7>, <Level_0>,... <Level_7>

<Enable_n>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable downlink timeslot no. n (the MS is instructed to listen to this TS)	see below	–	–
<Level_n>	Description of parameters	Def. value	Def. unit	Unit ring
–127 dB to +127 dB	Power of CMU in timeslot no. n (the CMU actually transmits a signal in this TS)	see below	dB	–

Description of command	Sig. State	FW vers.
This command changes the slot configuration and the RF levels that the CMU uses in test mode (default parameters). All levels are relative to the reference level queried via `[SENSe:]BSSignal:PDATa[:TCH]:MSLot:RLEVel?`. The level range quoted above is restricted by the condition that the absolute level (calculated from the reference level and the relative individual levels) must not exceed the level ranges of the RF connectors. **Example:** With output connector RF2 and a reference level of –90 dBm, the individual timeslot levels can be set in the range –47 dB to +80 dB, corresponding to an absolute level of –137 dBm to –10 dBm. In the default setting, slots 3 and 4 are enabled, both levels are 0 dB. By default, slot no. 3 is also the main timeslot; see `CONFigure:BSSignal:PDATa[:TCH]:MSLot:MTIMeslot` command on p. 6.193.	≠TEST, Q: all	V3.05

Subsystem NETWork

The subsystem *NETWork* determines the parameters of the radio network and the existing radio link. The subsystem corresponds to the *Network* tab in the popup menu *Connect. Control*. The following commands are related to packet data transfer:

CONFigure:NETWork:NSUPport Network Support

Return	Description of parameters	Def. value	Def. unit	Unit ring
GSM | **GGPR**	Circuit-switched GSM without GPRS support Circuit-switched GSM with GPRS support	GSM	–	–

Description of command	Sig. State	FW vers.
This command defines whether or not the CMU currently supports GPRS. It is available with option CMU-K42, *GPRS Software Extension*, only.	SOFF IDLE Q: all	V3.01

[SENSe:]NETWork:MSERvice? Main Service

Return	Description of parameters	Def. value	Def. unit	Unit ring
CSWitched | **PDATa**	Circuit switched GSM GPRS packet data service	CSW	–	–

Description of command	Sig. State	FW vers.
This command selects GSM or GPRS operation of the MS under test.	SOFF IDLE Q: all	V3.05

Subsystem NETWork:IDENtity

The subsystem *NETWork:IDENtity* defines the identity of the mobile radio network. The subsystem corresponds to the table section *Network Identity* in the *Network* tab. The following commands are related to packet data transfer:

CONFigure:NETWork:IDENtity:RAC <*Code*>				Routing Area Code
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 255	Routing area code	0	–	–
Description of command			Sig. State	FW vers.
This command defines the routing area code for GPRS services.			SOFF, IDLE Q: all	V3.05

Subsystem NETWork:PDATa

The subsystem *NETWork:PDATa* defines the GPRS test mode and the traffic data channel coding scheme. The subsystem corresponds to the table section *Network Identity* in the *Network* tab. The following commands are related to packet data transfer:

CONFigure:NETWork:PDATa:GPRS:CSCHeme <*Coding_Scheme*>				Coding Scheme
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CS1 to CS4	GPRS channel coding scheme CS-1 to CS-4	CS1	–	–
Description of command			Sig. State	FW vers.
This command selects the GPRS coding scheme for packet data channels.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:PCMChannel <*Type*>				PC Meas. Channel
<Type>	Description of parameters	Def. value	Def. unit	Unit ring
BCCH | PDCH	PC measurement channel	BCCH	–	–
Description of command			Sig. State	FW vers.
This command defines the channel type that the mobile uses to determine the received signal strength and quality.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:USF <*Code*>				Uplink State Flag
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Uplink State Flag	0	–	–
Description of command			Sig. State	FW vers.
This command defines the Uplink State Flag (USF) in the blocks transmitted to the MS while the CMU is in GPRS test mode.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:EDAllocation <*Enable*> Extend. Dyn. Alloc..

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF | AUTO	Enable or disable extended dynamic allocation Enable only if the MS supports extended dynamic allocation	AUTO	–	–
Description of command			Sig. State	FW vers.
This command enables or disables extended dynamic allocation of the mobile.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:NOPDus <*Number*> Number of PDUs

<Number>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 4095	Number of PDUs	4095	–	–
Description of command			Sig. State	FW vers.
This command defines the number of Protocol Data Units (PDUs) that the MS is to transmit in the uplink during GPRS test mode A.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:SOFFset <*Offset*> Slot Offset

<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Slot Offset	0	–	–
Description of command			Sig. State	FW vers.
This command defines the timeslot to be taken as the first downlink timeslot when the MS is in multislot operation.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:TWACk <*Enable*> Testmode with ACK

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable test mode with ACK	OFF	–	–
Description of command			Sig. State	FW vers.
This command enables or disables the operating mode where the mobile periodically transmits a PACKET_UPLINK_ACK_NACK message (GSM 04.60) while it is in test mode B.			SOFF, IDLE Q: all	V3.05

CONFigure:NETWork:PDATa:BITStream <*Mode*>
PROCedure:NETWork:PDATa:BITStream <*Mode*> Bit Stream

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
PR9 |	2^{9}-1 PSR bit pattern	PR9	–	–
PR11 |	2^{11}-1 PSR bit pattern			
PR15 |	2^{15}-1 PSR bit pattern			
PR16	2^{16}-1 PSR bit pattern			
Description of command			Sig. State	FW vers.
This command defines the pseudo random bit sequence that the CMU transmits to the MS in GPRS test mode. See note on *Current vs. default values* on p. 6.189.			all	V3.05

MSSinfo
(Signalling information of mobile phone)

The subsystem *MSSinfo* contains the commands for querying the parameters of the mobile. The subsystem corresponds to the *Signalling Info* output table in the main menu *GSMxxx-MS Overview*. The mobile parameters do not actually represent a measured value, they are provided by the mobile phone during location update. The following parameters are related to packet data transfer.

[SENSe:]MSSinfo:MSCLass:PDATa?				Multislot Class
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 29	Multislot class of mobile	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns the multislot class of the mobile while it operates in packet data mode.			ATT TEST	≥3.05

List of Commands

In the following, all remote control commands of the function group GSM900/1800/1900-MS are listed with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the two test modes *Non Signalling* and *Signalling* are listed separately.

Commands for GSM Module Tests

Table 6-1 Remote control commands: Non Signalling

Command, Non Signalling	**Parameter**	**Remark**	**Page**
Inputs and outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:DM:CLOCk:FREQuency	1.219 MHz to 39.000 MHz	with query	6.9
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.9
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.8
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.8
Input and output level			
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]LEVel:DEFault	ON | OFF	with query	6.2
[SENSe:]LEVel:MAXimum	<Level>	with query	6.2
[SENSe:]LEVel:MODE	MANual | AUTomatic	with query	6.1
Modulation measurement: 8PSK Modulation, Error Vector Magnitude			
INITiate:MODulation:EVMagnitude:EPSK	–	no query	6.77
ABORt:MODulation:EVMagnitude:EPSK	–	no query	6.77
STOP:MODulation:EVMagnitude:EPSK	–	no query	6.77
CONTinue:MODulation:EVMagnitude:EPSK	–	no query	6.77
CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.80

Command, Non Signalling	Parameter	Remark	Page
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK: AVERage?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK: AVERage?	–100.0 dB to +20.0 dB	query only	6.82
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.78
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:DEFault	ON | OFF	with query	6.79
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol: REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.78
CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.77
CALCulate:MODulation:EVMagnitude:EPSK:LIMit:MATChing?	<Result>	query only	6.81
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
READ:SUBarrays:MODulation:EVMagnitude:EPSK: MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK: MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK: MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:MODulation:EVMagnitude:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.77
READ[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
READ:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
READ:SUBarrays:MODulation:EVMagnitude:EPSK	–100.0 dB to +20.0 dB	query only	6.82

Command, Non Signalling	Parameter	Remark	Page
[:CURRent]?			
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK [:CURRent]?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK [:CURRent]?	–100.0 dB to +20.0 dB	query only	6.82
Modulation measurement: 8PSK Modulation, Magnitude Error			
INITiate:MODulation:MERRor:EPSK	–	no query	6.89
ABORt:MODulation:MERRor:EPSK	–	no query	6.89
STOP:MODulation:MERRor:EPSK	–	no query	6.89
CONTinue:MODulation:MERRor:EPSK	–	no query	6.89
CONFigure:SUBarrays:MODulation:MERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.92
READ:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
CONFigure:MODulation:MERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.90
CONFigure:MODulation:MERRor:EPSK:CONTrol:DEFault	ON | OFF	with query	6.91
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.90
CONFigure:MODulation:MERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.89
CALCulate:MODulation:MERRor:EPSK:LIMit:MATChing?	<Result>	query only	6.93
READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94

Command, Non Signalling	Parameter	Remark	Page
FETCh:MODulation:MERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.89
READ[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
FETCh[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
SAMPle[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
READ:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94
FETCh:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.74
CONFigure:MODulation:OEMP:EPSK:LIMit:DEFault	ON | OFF	with query	6.75
CONFigure:MODulation:OEMP:EPSK:LIMit:P95Th	<EVM95%>, <MError95%>, <PError95%>	with query	6.75
CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent]	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.74
Modulation measurement: 8PSK Modulation, Overview			
INITiate:MODulation:OVERview:EPSK	–	no query	6.72
ABORt:MODulation:OVERview:EPSK	–	no query	6.72
STOP:MODulation:OVERview:EPSK	–	no query	6.72
CONTinue:MODulation:OVERview:EPSK	–	no query	6.72
CONFigure:MODulation:OVERview:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.73
CONFigure:MODulation:OVERview:EPSK:CONTrol:DEFault	ON | OFF	with query	6.74
CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP |	with query	6.73

Command, Non Signalling	Parameter	Remark	Page
	NONE		
CONFigure:MODulation:OVERview:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.72
CALCulate:MODulation:OVERview:EPSK:LIMit:MATChing?	<Result>	query only	6.76
FETCh:MODulation:OVERview:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.72
READ[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75
FETCh[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75
SAMPle[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75
Modulation measurement: 8PSK Modulation, Phase Error			
INITiate:MODulation[:PERRor]:EPSK	–	no query	6.83
ABORt:MODulation[:PERRor]:EPSK	–	no query	6.83
STOP:MODulation[:PERRor]:EPSK	–	no query	6.83
CONTinue:MODulation[:PERRor]:EPSK	–	no query	6.83
CONFigure:SUBarrays:MODulation[:PERRor]:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.86
READ:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
SAMPle:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
CONFigure:MODulation[:PERRor]:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.84
CONFigure:MODulation[:PERRor]:EPSK:CONTrol:DEFault	ON | OFF	with query	6.85
CONFigure:MODulation[:PERRor]:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.84
CONFigure:MODulation[:PERRor]:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.83
CALCulate:MODulation[:PERRor]:EPSK:LIMit:MATChing?	<Result>	query only	6.87
READ:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88

Command, Non Signalling	Parameter	Remark	Page
SAMPle:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:MODulation[:PERRor]:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.83
READ[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
FETCh[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
SAMPle[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
READ:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
SAMPle:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
INITiate:MODulation[:PERRor][:GMSK]	–	no query	6.56
ABORt:MODulation[:PERRor][:GMSK]	–	no query	6.56
STOP:MODulation[:PERRor][:GMSK]	–	no query	6.56
CONTinue:MODulation[:PERRor][:GMSK]	–	no query	6.56
CONFigure:SUBarrays:MODulation[:PERRor][:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.60
READ:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.57

Command, Non Signalling	Parameter	Remark	Page
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.58
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.58
CONFigure:MODulation[:PERRor][:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.56
CONFigure:MODulation[:PERRor][:GMSK]:FILTer	G500 | B600	with query	6.57
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:AVERage	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 999 Hz	with query	6.59
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:DEFault	ON | OFF	with query	6.59
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:LOWer:MODE	ON | OFF	with query	6.59
CALCulate:MODulation[:PERRor][:GMSK]:LIMit:MATChing?	<Result>	query only	6.62
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:UPPer:MODE	ON | OFF	with query	6.59
CONFigure:MODulation[:PERRor][:GMSK]:LIMit[:CURRent]	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 999 Hz	with query	6.58
READ:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:MODulation[:PERRor][:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.57
CONFigure:MODulation[:PERRor][:GMSK]:TIME:DECode	STANdard | GTBits	with query	6.60
READ[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
FETCh[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
SAMPle[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
READ:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63

Command, Non Signalling	Parameter	Remark	Page
FETCh:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63
Modulation measurement: GMSK Modulation, Extended Phase Error			
INITiate:MODulation:XPERror[:GMSK]	–	no query	6.64
ABORt:MODulation:XPERror[:GMSK]	–	no query	6.64
STOP:MODulation:XPERror[:GMSK]	–	no query	6.64
CONTinue:MODulation:XPERror[:GMSK]	–	no query	6.64
CONFigure:SUBarrays:MODulation:XPERror[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.68
READ:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
CONFigure:MODulation:XPERror[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.66
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.64
CONFigure:MODulation:XPERror[:GMSK]:FILTer	G500 | B600	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:LIMit:AVERage	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, –100 dB to 0 dB, –100 dB to 0 dB, 0 Hz to 999 Hz	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit:DEFault	ON | OFF	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit:LOWer:MODE	ON | OFF	with query	6.67
CALCulate:MODulation:XPERror[:GMSK]:LIMit:MATChing?	<Result>	query only	6.70
CONFigure:MODulation:XPERror[:GMSK]:LIMit:UPPer:MODE	ON | OFF	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit[:CURRent]	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, –100 dB to 0 dB, –100 dB to 0 dB, 0 Hz to 999 Hz	with query	6.66

Command, Non Signalling	**Parameter**	**Remark**	**Page**
READ:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]: MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:MODulation:XPERror[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.64
CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode	STANdard | GTBits	with query	6.65
READ[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
FETCh[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
SAMPle[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
READ:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
NPOWer measurement			
INITiate:NPOWer	–	no query	6.32
ABORt:NPOWer	–	no query	6.32
STOP:NPOWer	–	no query	6.32
CONTinue:NPOWer	–	no query	6.32
CONFigure:NPOWer:CONTrol	1 to 1000 | NONE,CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.33
CONFigure:NPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.34
CONFigure:NPOWer:CONTrol:STATistics	1 to 1000 | NONE	with query	6.33
CONFigure:NPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.32

Command, Non Signalling	Parameter	Remark	Page
FETCh:NPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.32
READ[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
FETCh[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
SAMPle[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
POWer:FRAMe measurement			
INITiate:POWer:FRAMe	–	no query	6.44
ABORt:POWer:FRAMe	–	no query	6.44
STOP:POWer:FRAMe	–	no query	6.44
CONTinue:POWer:FRAMe	–	no query	6.44
CONFigure:SUBarrays:POWer:FRAMe	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.46
CONFigure:POWer:FRAMe:CONTrol:DEFault	ON | OFF	with query	6.45
CONFigure:POWer:FRAMe:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.45
CONFigure:POWer:FRAMe:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.44
CONFigure:POWer:FRAMe:FCOunt	1 to 128	with query	6.44
READ[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
FETCh[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
SAMPle[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
FETCh:POWer:FRAMe:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.44
READ:ARRay:POWer:FRAMe?	<Result>	query only	6.47
FETCh:ARRay:POWer:FRAMe?	<Result>	query only	6.47
SAMPle:ARRay:POWer:FRAMe?	<Result>	query only	6.47
READ:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47
FETCh:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47
SAMPle:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47

Command, Non Signalling	Parameter	Remark	Page
POWer:MSLot measurement			
INITiate:POWer:MSLot	–	no query	6.48
ABORt:POWer:MSLot	–	no query	6.48
STOP:POWer:MSLot	–	no query	6.48
CONTinue:POWer:MSLot	–	no query	6.48
CONFigure:SUBarrays:POWer:MSLot	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.51
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:AVERage?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MAXimum?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MINimum?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.55
READ:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
CONFigure:POWer:MSLot:CONTrol	SCALar | ARRay, 1 to 1000 | OFF	with query	6.49
DISPlay:POWer:MSLot:CONTrol:GRID	ON | OFF	with query	6.49
CONFigure:POWer:MSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.49
CONFigure:POWer:MSLot:CONTrol:DEFault	ON | OFF	with query	6.50
CONFigure:POWer:MSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.48
CONFigure:POWer:MSLot:FILTer	G500 | B600	with query	6.51
CONFigure:POWer:MSLot:LIMit:LINE:GLEVel	0.00 dB to +10.00 dB	with query	6.51
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:AVERage?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MAXimum?	<Matching>	query only	6.55

Command, Non Signalling	**Parameter**	**Remark**	**Page**
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MINimum?	<Matching>	query only	6.55
CALCulate:POWer:MSLot:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.53
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.55
READ:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
READ:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
CONFigure:POWer:MSLot:MVIew	<Mod_-1>,<Mod_0>, <Mod_1>, <Mod_2>	with query	6.50
CONFigure:POWer:MSLot:SCOunt	1 to 4	with query	6.50
FETCh:POWer:MSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.48
CONFigure:POWer:MSLot:TOFFset	–4.00 to +4.00	with query	6.50
READ[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
FETCh[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
SAMPle[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
READ:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54

Command, Non Signalling	Parameter	Remark	Page
FETCh:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54
POWer:SLOT measurement			
INITiate:POWer:SLOT	–	no query	6.35
ABORt:POWer:SLOT	–	no query	6.35
STOP:POWer:SLOT	–	no query	6.35
CONTinue:POWer:SLOT	–	no query	6.35
CONFigure:SUBarrays:POWer:SLOT	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.37
CONFigure:POWer:SLOT:CONTrol:DEFault	ON | OFF	with query	6.36
CONFigure:POWer:SLOT:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.36
CONFigure:POWer:SLOT:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.35
READ[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
FETCh[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
SAMPle[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
FETCh:POWer:SLOT:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.35
READ:ARRay:POWer:SLOT?	<Result>	query only	6.38
FETCh:ARRay:POWer:SLOT?	<Result>	query only	6.38
SAMPle:ARRay:POWer:SLOT?	<Result>	query only	6.38
READ:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
FETCh:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
SAMPle:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
POWer:XSLOT measurement			
INITiate:POWer:XSLot	–	no query	6.39
ABORt:POWer:XSLot	–	no query	6.39
STOP:POWer:XSLot	–	no query	6.39
CONTinue:POWer:XSLot	–	no query	6.39

Command, Non Signalling	Parameter	Remark	Page
CONFigure:SUBarrays:POWer:XSLot	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.42
CONFigure:POWer:XSLot:CONTrol:DEFault	ON | OFF	with query	6.40
CONFigure:POWer:XSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.40
CONFigure:POWer:XSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.39
CONFigure:POWer:XSLot:SCOunt	S128 | S256 | S384 | S512[,1 to 512]	with query	6.41
READ[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
FETCh[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
SAMPle[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
FETCh:POWer:XSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.39
READ:ARRay:POWer:XSLot?	<Result>	query only	6.43
FETCh:ARRay:POWer:XSLot?	<Result>	query only	6.43
SAMPle:ARRay:POWer:XSLot?	<Result>	query only	6.43
READ:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
FETCh:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
SAMPle:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
POWer versus time measurement: 8PSK modulation			
INITiate:POWer[:NORMal]:EPSK	–	no query	6.10
ABORt:POWer[:NORMal]:EPSK	–	no query	6.10
STOP:POWer[:NORMal]:EPSK	–	no query	6.10
CONTinue:POWer[:NORMal]:EPSK	–	no query	6.10
CONFigure:SUBarrays:POWer[:NORMal]:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.19
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:AVERage?	<Matching>	query only	6.23
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MAXimum?	<Matching>	query only	6.23

Command, Non Signalling	Parameter	Remark	Page
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MINimum?	<Matching>	query only	6.23
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.23
READ:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
CONFigure:POWer[:NORMal]:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.12
CONFigure:POWer[:NORMal]:EPSK:CONTrol:DEFault	ON | OFF	with query	6.13
DISPlay:POWer[:NORMal]:EPSK:CONTrol:GRID	ON | OFF	with query	6.12
CONFigure:POWer[:NORMal]:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.12
CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode	CURRent | AVERage | DCOMpens	with query	6.12
CONFigure:POWer[:NORMal]:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.10
CONFigure:POWer[:NORMal]:EPSK:FILTer	G500 | B600	with query	6.11
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.18
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer:ALL:DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>:DYNamic<RgNr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.17
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.15
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]:ENABle	ON | OFF	with query	6.15
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer:ALL:DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:	ON | OFF	with query	6.16

Command, Non Signalling	Parameter	Remark	Page
UPPer<nr>:ALL:DYNamic:ENABle			
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>:DYNamic<nr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.16
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>:DYNamic<nr>:ENABle	ON | OFF	with query	6.16
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.13
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>[:STATic]:ENABle	ON | OFF	with query	6.13
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:AVERage?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MAXimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MINimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
CALCulate[:SCALar]:POWer[:NORMal]:EPSK:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.20
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing[:CURRent]?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
READ:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.22
READ:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:POWer[:NORMal]:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.11

Command, Non Signalling	Parameter	Remark	Page
CONFigure:POWer[:NORMal]:EPSK:TIME:BOFFset	–4.00 to +4.00	with query	6.11
READ[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.19
FETCh[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.19
SAMPle[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.19
READ:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22
POWer versus time measurement: GMSK modulation			
INITiate:POWer[:NORMal][:GMSK]	–	no query	6.10
ABORt:POWer[:NORMal][:GMSK]	–	no query	6.10
STOP:POWer[:NORMal][:GMSK]	–	no query	6.10
CONTinue:POWer[:NORMal][:GMSK]	–	no query	6.10
CONFigure:SUBarrays:POWer[:NORMal][:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.19
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:AVERage?	<Matching>	query only	6.23
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MAXimum?	<Matching>	query only	6.23
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MINimum?	<Matching>	query only	6.23
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.23
READ:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.22

Command, Non Signalling	Parameter	Remark	Page
CONFigure:POWer[:NORMal][:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.12
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.13
DISPlay:POWer[:NORMal][:GMSK]:CONTrol:GRID	ON | OFF	with query	6.12
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.12
CONFigure:POWer[:NORMal][:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.10
CONFigure:POWer[:NORMal][:GMSK]:FILTer	G500 | B600	with query	6.11
CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>	ON | OFF	with query	6.18
CONFigure:POWer[:NORMal][:GMSK]:LIMit: ABPower<nr>:ENABle	ON | OFF	with query	6.18
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.18
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:LOWer:ALL: DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<AreaNr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>:DYNamic<RgNr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.17
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.15
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>[:STATic]:ENABle	ON | OFF	with query	6.15
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer:ALL:DYNamic:ENABle	ON | OFF	with query	6.17
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.16
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:DYNamic<nr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.16
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:DYNamic<nr>:ENABle	ON | OFF	with query	6.16
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.13
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>[:STATic]:ENABle	ON | OFF	with query	6.13
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:	MATC | NMAT | INV | NTSC | OUT	query only	6.23

Command, Non Signalling	Parameter	Remark	Page
MATChing:AVERage?			
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing:MAXimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing:MINimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
CALCulate[:SCALar]:POWer[:NORMal][:GMSK]:LIMit: MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.20
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing[:CURRent]?	MATC | NMAT | INV | NTSC | OUT	query only	6.23
READ:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.22
READ:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.22
FETCh:POWer[:NORMal][:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.11
CONFigure:POWer[:NORMal][:GMSK]:TIME:BOFFset	–4.00 to +4.00	with query	6.11
READ[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.19
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.19
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.19
READ:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
FETCh:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
SAMPle:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.21
READ:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22

Command, Non Signalling	Parameter	Remark	Page
FETCh:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22
SAMPle:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.22
POWer:MPR measurement			
INITiate:POWer[:NORMal][:GMSK]:MPR	–	no query	6.24
ABORt:POWer[:NORMal][:GMSK]:MPR	–	no query	6.24
STOP:POWer[:NORMal][:GMSK]:MPR	–	no query	6.24
CONTinue:POWer[:NORMal][:GMSK]:MPR	–	no query	6.24
CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.26
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.27
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.27
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.27
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.28
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.28
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 dB to +20.0 dB	query only	6.28
CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.25
CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.25
CONFigure:POWer[:NORMal][:GMSK]:MPR:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.24
CALCulate[:SCALar]	POWer[:NORMal][:GMSK]:MPR:LIMit:MATChing?	<Result>	query only
6.29			
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.27
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.27
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.27
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.28
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.28
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.28

Command, Non Signalling	Parameter	Remark	Page
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.27
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.27
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.27
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.28
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.28
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR: MINimum?	–100.0 dB to +20.0 dB	query only	6.28
FETCh:POWer[:NORMal][:GMSK]:MPR:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.24
READ[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.27
FETCh[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.27
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.27
READ:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.27
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.27
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.27
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.28
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR [:CURRent]?	–100.0 dB to +20.0 dB	query only	6.28
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR [:CURRent]?	–100.0 dB to +20.0 dB	query only	6.28
RF Signal received			
[SENSe:]RFANalyzer:CHANnel	0.2 MHz to 2700 MHz	with query	6.3
[SENSe:]RFANalyzer:FREQuency:OFFSet	–10 kHz to 10 kHz	with query	6.4
CONFigure:RFANalyzer:MCONTrol:TSOFfset	0 to 7	with query	6.4
[SENSe:]RFANalyzer:MODulation	GMSK | EPSK	with query	6.4
[SENSe:]RFANalyzer:TSEQuence	OFF | GSM0 to GSM7 | DUMMy	with query	6.4
RF Signal generated			
INITiate:RFGenerator	–	no query	6.5
ABORt:RFGenerator	–	no query	6.5
SOURce:RFGenerator:FM:DEViation	–10 kHz to 10 kHz	with query	6.6

Command, Non Signalling	Parameter	Remark	Page
SOURce:RFGenerator:FREQuency[:CHANnel]	0.2 MHz to 2700 MHz	with query	6.6
SOURce:RFGenerator:LEVel:UNTimeslot	<Level>	with query	6.6
SOURce:RFGenerator:LEVel:UTIMeslot	<Level>	with query	6.5
CONFigure:RFGenerator:MODulation:BIT:SELection	OFF | PRBS | DUMMybursts	with query	6.7
CONFigure:RFGenerator:MODulation:TRANsmission	BURSt | CONTinuous	with query	6.7
CONFigure:RFGenerator:MODulation:TSEQuence:SELection	GSM0 to GSM7 | DUMMy	with query	6.7
FETCh:RFGenerator:STATus?	OFF | RUN | ERR	query only	6.5
Spectrum due to modulation measurements: 8PSK modulation			
INITiate:SPECtrum:MODulation:EPSK	–	no query	6.95
ABORt:SPECtrum:MODulation:EPSK	–	no query	6.95
STOP:SPECtrum:MODulation:EPSK	–	no query	6.95
CONTinue:SPECtrum:MODulation:EPSK	–	no query	6.95
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.96
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:DEFault	ON | OFF	with query	6.98
DISPlay:SPECtrum:MODulation:EPSK:CONTrol:GRID	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:CONTrol: MPOint<nr>:ENABle	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.95
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE: MODE[:UPPer]	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE: REFPower[:UPPer]	<Minimum>, <Maximum>	with query	6.99
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE [:ASYMmetrical]:UPPer<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.98
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE [:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.98

Command, Non Signalling	Parameter	Remark	Page
FETCh:SPECtrum:MODulation:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.96
READ[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
FETCh[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
READ:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
READ:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
Spectrum due to modulation measurements: GMSK modulation			
INITiate:SPECtrum:MODulation[:GMSK]	–	no query	6.95
ABORt:SPECtrum:MODulation[:GMSK]	–	no query	6.95
STOP:SPECtrum:MODulation[:GMSK]	–	no query	6.95
CONTinue:SPECtrum:MODulation[:GMSK]	–	no query	6.95
CONFigure:SUBarrays:SPECtrum:MODulation[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.100
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.96
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.98
DISPlay:SPECtrum:MODulation[:GMSK]:CONTrol:GRID	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol: MPOint<nr>:ENABle	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol: REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.95
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE: MODE[:UPPer]	ON | OFF	with query	6.100

Command, Non Signalling	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:REFPower[:UPPer]	<Minimum>, <Maximum>	with query	6.99
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.98
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.98
FETCh:SPECtrum:MODulation[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.96
READ[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
FETCh[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
SAMPle[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
READ:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
READ:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
Spectrum due to switching measurements: 8PSK modulation			
INITiate:SPECtrum:SWITching:EPSK	–	no query	6.103
ABORt:SPECtrum:SWITching:EPSK	–	no query	6.103
STOP:SPECtrum:SWITching:EPSK	–	no query	6.103
CONTinue:SPECtrum:SWITching:EPSK	–	no query	6.103
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.108
CONFigure:SPECtrum:SWITching:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.104
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:DEFault	ON | OFF	with query	6.105
DISPlay:SPECtrum:SWITching:EPSK:CONTrol:GRID	ON | OFF	with query	6.104
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:MPOint<nr>:ENABle	ON | OFF	with query	6.105
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP |	with query	6.104

Command, Non Signalling	Parameter	Remark	Page
	NONE		
CONFigure:SPECtrum:SWITching:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching:EPSK:LIMit: LINE:MODE[:UPPer]	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching:EPSK:LIMit: LINE[:ASYMmetrical]:UPPer<nr>	<Power level>, <Limit at 0.4 MHz>, <Limit at 0.6 MHz>, <Limit at 1.2 MHz>, <Limit at 1.8 MHz>,<Enable>	with query	6.106
CONFigure:SPECtrum:SWITching:EPSK:LIMit: LINE[:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.106
FETCh:SPECtrum:SWITching:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.103
READ[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
FETCh[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
READ:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
FETCh:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
SAMPle:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
READ:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
FETCh:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.100
SAMPle:SUBarrays:SPECtrum:SWITching?	–100.0 dB to +20.0 dB, ...	query only	6.53
Spectrum due to switching measurements: GMSK modulation			
INITiate:SPECtrum:SWITching[:GMSK]	–	no query	6.103
ABORt:SPECtrum:SWITching[:GMSK]	–	no query	6.103
STOP:SPECtrum:SWITching[:GMSK]	–	no query	6.103
CONTinue:SPECtrum:SWITching[:GMSK]	–	no query	6.103
CONFigure:SUBarrays:SPECtrum:SWITching[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>, <Samples>}	with query	6.108
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 |	with query	6.104

Command, Non Signalling	Parameter	Remark	Page
	NONE		
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.105
DISPlay:SPECtrum:SWITching[:GMSK]:CONTrol:GRID	ON | OFF	with query	6.104
CONFigure:SPECtrum:SWITching[:GMSK]: CONTrol:MPOint<nr>:ENABle	ON | OFF	with query	6.105
CONFigure:SPECtrum:SWITching[:GMSK]: CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.104
CONFigure:SPECtrum:SWITching[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching[:GMSK]: LIMit:LINE:MODE[:UPPer]	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching[:GMSK]: LIMit:LINE[:ASYMmetrical]:UPPer<nr>	<Power level>, <Limit at 0.4 MHz>, <Limit at 0.6 MHz>, <Limit at 1.2 MHz>, <Limit at 1.8 MHz>,<Enable>	with query	6.106
CONFigure:SPECtrum:SWITching[:GMSK]: LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.106
FETCh:SPECtrum:SWITching[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.103
READ[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
FETCh[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
SAMPle[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
READ:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
FETCh:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
SAMPle:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
READ:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
FETCh:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.111
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.111

Command, Non Signalling	**Parameter**	**Remark**	**Page**
Trigger			
TRIGger[:SEQuence]:DEFault	ON | OFF	with query	6.3
TRIGger[:SEQuence]:SOURce	IMMediate | RFPower | IFPower | EXTern	with query	6.2
TRIGger[:SEQuence]:THReshold	LOW | MEDium | HIGH	with query	6.3
Measured wide band power			
INITiate:WPOWer	–	no query	6.30
ABORt:WPOWer	–	no query	6.30
STOP:WPOWer	–	no query	6.30
CONTinue:WPOWer	–	no query	6.30
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.31
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.30
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 ... 10000 | NONE	query only	6.31
READ[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31
FETCh[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31
SAMPle[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31

Commands for GSM Measurements with Signalling

Table 6-2 Remote control commands: Signalling mode

Command, Signalling	**Parameter**	**Remark**	**Page**
RF generator signal of CMU			
CONFigure:BSSignal:CCH:CHANnel	<Channel>	with query	6.171
CONFigure:BSSignal:CCH:LEVel[:ABSolute]	<Level>	with query	6.171
CONFigure:BSSignal:CCH:MODE	BATC | BOTC	with query	6.170
CONFigure:BSSignal:FM:DEViation	–100 kHz to +100 kHz	with query	6.170
CONFigure:BSSignal:PDATa[:TCH]:MSLot:CHANnel	<Number>	with query	6.193
CONFigure:BSSignal:PDATa[:TCH]:MSLot:MTIMeslot	<Number>	with query	6.193
CONFigure:BSSignal:PDATa[:TCH]:MSLot:PZERo	<P0>	with query	6.193
[SENSe:]BSSignal:PDATa[:TCH]:MSLot:RLEVel?	<Level>	query only	6.193
CONFigure:BSSignal:PDATa[:TCH]:MSLot:SCONfig	<Enable_0>,..., <Enable_7>, <Level_0>,... <Level_7>	with query	6.194
CONFigure:BSSignal[:CSWitched][:TCH]:CHANnel	<TCHChannel>	with query	6.171
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot	<Level>	with query	6.172
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UNTimeslot	<Level>	with query	6.172
CONFigure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot	<Level>	with query	6.171
PROCedure:BSSignal[:CSWitched][:TCH]:LEVel:UTIMeslot	<Level>	with query	6.171
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:LMODe	UUN | IND	with query	6.174
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:MTIMeslot	0 to 7	with query	6.173
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel	<Level>	with query	6.173
PROCedure:BSSignal[:CSWitched][:TCH]:MSLot:RLEVel	<Level>	with query	6.173
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig: INDividual	<Enable_0>,<Enable_1>, ..., <Enable_7>, <PCL_0>, ..., <PCL_7>	with query	6.175
CONFigure:BSSignal[:CSWitched][:TCH]:MSLot:SCONfig:UUNused	<Enable_0>,<Enable_1>, ..., <Enable_7>	with query	6.174
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:A	<Channel>{,<Channel>}	with query	6.172
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:B	Channel>{,<Channel>}	with query	6.172
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:C	Channel>{,<Channel>}	with query	6.172
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:FHOPping:D	Channel>{,<Channel>}	with query	6.172

Command, Signalling	Parameter	Remark	Page
CONFigure:BSSignal[:CSWitched][:TCH][:SSLot]:TIMeslot	2 to 6 | 0 to 7	with query	6.172
Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.184
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.184
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.184
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.184
SOURce:DM:CLOCk:FREQuency	1.2190 MHz to 39.000 MHz	with query	6.185
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.185
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.183
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.183
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.162
[SENSe:]LEVel:DEFault	ON | OFF	with query	6.162
[SENSe:]LEVel:MAXimum	<Level>	with query	6.161
[SENSe:]LEVel:MODE	MANual | PCLevel | AUTomatic	with query	6.161
Handover			
CONFigure:HANDover:TARGet	<Target>	with query	6.168
STATus:HANDover:TARGet:LIST?	<List>	query only	6.168
Modulation measurement: 8PSK Modulation, Error Vector Magnitude			
INITiate:MODulation:EVMagnitude:EPSK	–	no query	6.77
ABORt:MODulation:EVMagnitude:EPSK	–	no query	6.77
STOP:MODulation:EVMagnitude:EPSK	–	no query	6.77
CONTinue:MODulation:EVMagnitude:EPSK	–	no query	6.77
CONFigure:SUBarrays:MODulation:EVMagnitude:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.80
READ:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.82

Command, Signalling	Parameter	Remark	Page
READ:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.82
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.78
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:DEFault	ON | OFF	with query	6.79
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.78
CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.77
CALCulate:MODulation:EVMagnitude:EPSK:LIMit:MATChing?	<Result>	query only	6.81
READ:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.82
READ:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK: MMAXimum?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:MODulation:EVMagnitude:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.77
READ[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
FETCh[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
SAMPle[:SCALar]:MODulation:EVMagnitude:EPSK?	<Result>	query only	6.81
READ:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
FETCh:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
SAMPle:ARRay:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.82
READ:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.82
FETCh:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.82
SAMPle:SUBarrays:MODulation:EVMagnitude:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.82
Modulation measurement: 8PSK Modulation, Magnitude Error			
INITiate:MODulation:MERRor:EPSK	–	no query	6.89
ABORt:MODulation:MERRor:EPSK	–	no query	6.89

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STOP:MODulation:MERRor:EPSK	–	no query	6.89
CONTinue:MODulation:MERRor:EPSK	–	no query	6.89
CONFigure:SUBarrays:MODulation:MERRor:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.92
READ:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
FETCh:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.94
CONFigure:MODulation:MERRor:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.90
CONFigure:MODulation:MERRor:EPSK:CONTrol:DEFault	ON | OFF	with query	6.91
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.90
CONFigure:MODulation:MERRor:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.89
CALCulate:MODulation:MERRor:EPSK:LIMit:MATChing?	<Result>	query only	6.93
READ:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
FETCh:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:MODulation:MERRor:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.89
READ[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
FETCh[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
SAMPle[:SCALar]:MODulation:MERRor:EPSK?	<Result>	query only	6.93
READ:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94

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FETCh:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94
SAMPle:ARRay:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.94
READ:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
FETCh:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
SAMPle:SUBarrays:MODulation:MERRor:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.94
CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMError Peak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.74
CONFigure:MODulation:OEMP:EPSK:LIMit:DEFault	ON | OFF	with query	6.75
CONFigure:MODulation:OEMP:EPSK:LIMit:P95Th	<EVM95%>, <MError95%>, <PError95%>	with query	6.75
CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent]	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMError Peak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.74
Modulation measurement: 8PSK Modulation, Overview			
INITiate:MODulation:OVERview:EPSK	–	no query	6.72
ABORt:MODulation:OVERview:EPSK	–	no query	6.72
STOP:MODulation:OVERview:EPSK	–	no query	6.72
CONTinue:MODulation:OVERview:EPSK	–	no query	6.72
CONFigure:MODulation:OVERview:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.73
CONFigure:MODulation:OVERview:EPSK:CONTrol:DEFault	ON | OFF	with query	6.74
CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.73
CONFigure:MODulation:OVERview:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.72
CALCulate:MODulation:OVERview:EPSK:LIMit:MATChing?	<Result>	query only	6.76
FETCh:MODulation:OVERview:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.72
READ[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75

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FETCh[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75
SAMPle[:SCALar]:MODulation:OVERview:EPSK?	<Result>	query only	6.75
Modulation measurement: 8PSK Modulation, Phase Error			
INITiate:MODulation[:PERRor]:EPSK	–	no query	6.83
ABORt:MODulation[:PERRor]:EPSK	–	no query	6.83
STOP:MODulation[:PERRor]:EPSK	–	no query	6.83
CONTinue:MODulation[:PERRor]:EPSK	–	no query	6.83
CONFigure:SUBarrays:MODulation[:PERRor]:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.86
READ:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
SAMPle:ARRay:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.88
CONFigure:MODulation[:PERRor]:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.84
CONFigure:MODulation[:PERRor]:EPSK:CONTrol:DEFault	ON | OFF	with query	6.85
CONFigure:MODulation[:PERRor]:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.84
CONFigure:MODulation[:PERRor]:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.83
CALCulate:MODulation[:PERRor]:EPSK:LIMit:MATChing?	<Result>	query only	6.87
READ:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88
SAMPle:ARRay:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:MODulation[:PERRor]:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.83

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READ[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
FETCh[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
SAMPle[:SCALar]:MODulation[:PERRor]:EPSK?	<Result>	query only	6.87
READ:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
FETCh:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
SAMPle:ARRay:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +100.0 dB	query only	6.88
READ:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
FETCh:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
SAMPle:SUBarrays:MODulation[:PERRor]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.88
INITiate:MODulation[:PERRor][:GMSK]	–	no query	6.56
ABORt:MODulation[:PERRor][:GMSK]	–	no query	6.56
STOP:MODulation[:PERRor][:GMSK]	–	no query	6.56
CONTinue:MODulation[:PERRor][:GMSK]	–	no query	6.56
CONFigure:SUBarrays:MODulation[:PERRor][:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.60
READ:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.63
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.57
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.58
CONFigure:MODulation[:PERRor][:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.58
CONFigure:MODulation[:PERRor][:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.56
CONFigure:MODulation[:PERRor][:GMSK]:FILTer	G500 | B600	with query	6.57
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:AVERage	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 999 Hz	with query	6.59

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CONFigure:MODulation[:PERRor][:GMSK]:LIMit:DEFault	ON | OFF	with query	6.59
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:LOWer:MODE	ON | OFF	with query	6.59
CALCulate:MODulation[:PERRor][:GMSK]:LIMit:MATChing?	<Result>	query only	6.62
CONFigure:MODulation[:PERRor][:GMSK]:LIMit:UPPer:MODE	ON | OFF	with query	6.59
CONFigure:MODulation[:PERRor][:GMSK]:LIMit[:CURRent]	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, 0 Hz to 999 Hz	with query	6.58
READ:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:MODulation[:PERRor][:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.57
CONFigure:MODulation[:PERRor][:GMSK]:TIME:DECode	STANdard | GTBits	with query	6.60
READ[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
FETCh[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
SAMPle[:SCALar]:MODulation[:PERRor][:GMSK]?	<Result>	query only	6.61
READ:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
FETCh:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
SAMPle:ARRay:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.62
READ:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63
FETCh:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63
SAMPle:SUBarrays:MODulation[:PERRor][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.63
Modulation measurement: GMSK Modulation, Extended Phase Error			
INITiate:MODulation:XPERror[:GMSK]	–	no query	6.64
ABORt:MODulation:XPERror[:GMSK]	–	no query	6.64
STOP:MODulation:XPERror[:GMSK]	–	no query	6.64
CONTinue:MODulation:XPERror[:GMSK]	–	no query	6.64
CONFigure:SUBarrays:MODulation:XPERror[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum |	with query	6.68

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	IVAL,<Start>,<Samples>{,<Start>,<Samples>}		
READ:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.71
CONFigure:MODulation:XPERror[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.66
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.64
CONFigure:MODulation:XPERror[:GMSK]:FILTer	G500 | B600	with query	6.65
CONFigure:MODulation:XPERror[:GMSK]:LIMit:AVERage	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, –100 dB to 0 dB, –100 dB to 0 dB, 0 Hz to 999 Hz	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit:DEFault	ON | OFF	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit:LOWer:MODE	ON | OFF	with query	6.67
CALCulate:MODulation:XPERror[:GMSK]:LIMit:MATChing?	<Result>	query only	6.70
CONFigure:MODulation:XPERror[:GMSK]:LIMit:UPPer:MODE	ON | OFF	with query	6.67
CONFigure:MODulation:XPERror[:GMSK]:LIMit[:CURRent]	0.0 deg to 50.0 deg, 0.0 deg to 50.0 deg, –100 dB to 0 dB, –100 dB to 0 dB, 0 Hz to 999 Hz	with query	6.66
READ:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK]:MMAXimum?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:MODulation:XPERror[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 |	query only	6.64

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	NONE, 1 to 1000 | NONE		
CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode	STANdard | GTBits	with query	6.65
READ[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
FETCh[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
SAMPle[:SCALar]:MODulation:XPERror[:GMSK]?	<Result>	query only	6.69
READ:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
FETCh:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
SAMPle:ARRay:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +100.0 dB	query only	6.70
READ:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
FETCh:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
SAMPle:SUBarrays:MODulation:XPERror[:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.71
RF signal of the mobile phone			
CONFigure:MSSignal:CCH:PMAX	<Level>	with query	6.169
CONFigure:MSSignal:MCONtrol:MESLot	0 to 7	with query	6.168
CONFigure:MSSignal:PDATa[:TCH]:MSLot:SCONfig	<Enable_0>,..., <Enable_7>, <Gamma_0>,... <Gamma_7>	with query	6.192
CONFigure:MSSignal[:CSWitched]:DTX	ON | OFF	with query	6.169
CONFigure:MSSignal[:CSWitched][:TCH]:MSLot:SCONfig	<Enable_0>,<Enable_1>, ..., <Enable_7>, <PCL_0>, ..., <PCL_7>	with query	6.170
CONFigure:MSSignal[:CSWitched][:TCH]:TADVance	0 bit to 63 bit	with query	6.169
CONFigure:MSSignal[:CSWitched][:TCH][:SSLot]:MS:PCL	<Level>	with query	6.169
Parameters of the mobile phone			
[SENSe:]MSSinfo:DNUMber?	Max. 20-digit	query only	6.188
[SENSe:]MSSinfo:IMEI:FAC?	2-digit | NAN	query only	6.187
[SENSe:]MSSinfo:IMEI:SNR?	6-digit | NAN	query only	6.187
[SENSe:]MSSinfo:IMEI:SVN?	1 | 2-digit | NAN	query only	6.187
[SENSe:]MSSinfo:IMEI:TAC?	6-digit | NAN	query only	6.187
[SENSe:]MSSinfo:IMSI:MCC?	0 to 999 | NAN	query only	6.187
[SENSe:]MSSinfo:IMSI:MNC?	0 to 99 | NAN	query only	6.187

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[SENSe:]MSSinfo:IMSI:MSIN?	"0" to "9999999999" | NAN	query only	6.187
[SENSe:]MSSinfo:MSCLass:CSWitched?	1 to 29	query only	6.188
[SENSe:]MSSinfo:MSCLass:PDATa?	1 to 29	query only	6.197
[SENSe:]MSSinfo:POWer:CLASs?	1 to 5	query only	6.188
[SENSe:]MSSinfo:REVision?	PH1 | PH2 | PH2P	query only	6.187
[SENSe:]MSSinfo:TRAFfic?	FRV1 | FRV2 | HRV1 | FD48 | FD96 | FD14 | HD24 | HD48 | C1TM to C4TM, MC1T to MC9T	query only	6.188
Network parameters			
CONFigure:NETWork:BAList	<Channel> {,<Channel>}	with query	6.175
CONFigure:NETWork:IDENtity:BCC	0 to 7	with query	6.177
CONFigure:NETWork:IDENtity:LAC	1 to 65533 and 65535	with query	6.177
CONFigure:NETWork:IDENtity:MCC	0 to 999	with query	6.176
CONFigure:NETWork:IDENtity:MNC	0 to 99	with query	6.177
CONFigure:NETWork:IDENtity:NCC	0 to 7	with query	6.176
CONFigure:NETWork:NSUPport	GSM | GGPR	with query	6.194
CONFigure:NETWork:IDENtity:RAC	0 to 255	with query	6.195
[SENSe:]NETWork:MSERvice?	CSWitched | PDATa	query only	6.194
CONFigure:NETWork:PDATa:BITStream	PR9 | PR11 | PR15 | PR16	with query	6.196
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CONFigure:NETWork:PDATa:EDAllocation	ON | OFF | AUTO	with query	6.196
CONFigure:NETWork:PDATa:GPRS:CSCHeme	CS1 to CS4	with query	6.195
CONFigure:NETWork:PDATa:NOPDus	1 to 4095	with query	6.196
CONFigure:NETWork:PDATa:PCMChannel	BCCH | PDCH	with query	6.195
CONFigure:NETWork:PDATa:SOFFset	0 to 7	with query	6.196
CONFigure:NETWork:PDATa:TWACk	ON | OFF	with query	6.196
CONFigure:NETWork:PDATa:USF	0 to 7	with query	6.195
CONFigure:NETWork:SYSTem:ACLass	0 to 2^{16}–1	with query	6.178
CONFigure:NETWork:SYSTem:BSAGblksres	0 to 7	with query	6.177

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CONFigure:NETWork:SYSTem:BSPamfrms	2 to 9	with query	6.178
CONFigure:NETWork:SYSTem:BSPReorganis	ON|OFF	with query	6.178
CONFigure:NETWork:SYSTem:CACCess	BARRed | NBARred	with query	6.177
CONFigure:NETWork[:CSWitched]:AOCHarge	<Value1>, <Value2> ... , <Value7>	with query	6.176
CONFigure:NETWork[:CSWitched]:AOCHarge:ENABle	ON | OFF		6.176
CONFigure:NETWork[:CSWitched]:REQuest:AUTHenticate	ON | OFF	with query	6.182
CONFigure:NETWork[:CSWitched]:REQuest:HANDover	ON | OFF	with query	6.182
CONFigure:NETWork[:CSWitched]:REQuest:IMEI	ON | OFF	with query	6.181
CONFigure:NETWork[:CSWitched]:REQuest:IMSI	ON | OFF	with query	6.181
CONFigure:NETWork[:CSWitched]:SMODe:BITStream	ECHO | LOOP | PR9 | PR11 | PR15 | PR16 | HANDset | HLOW | CCAL | ECAL | DCAL	with query	6.180
PROCedure:NETWork[:CSWitched]:SMODe:BITStream	ECHO | LOOP | PR9 | PR11 | PR15 | PR16 | HANDset | HLOW | CCAL | ECAL | DCAL	with query	6.180
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MCC	0 to 999	with query	6.181
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MNC	0 to 99	with query	6.181
CONFigure:NETWork[:CSWitched]:SMODe:IMSI:MSIN	"0" to "9999999999"	with query	6.181
CONFigure:NETWork[:CSWitched]:SMODe:LCOMmand	ENABle | DISable | BER	with query	6.180
CONFigure:NETWork[:CSWitched]:SMODe:LOCupdate	ALWays | AUTO	with query	6.178
CONFigure:NETWork[:CSWitched]:SMODe:PCHange	FAST | SLOW	with query	6.179
CONFigure:NETWork[:CSWitched]:SMODe:SCHannel	SDCCh | FACCh | NONE	with query	6.179
CONFigure:NETWork[:CSWitched]:SMODe:STIMe	0 to 600	with query	6.180
PROCedure:NETWork[:CSWitched]:SMODe:STIMe	0 to 600	with query	6.180
CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic	FRV1 | FRV2 | HRV1 | FD24 | FD48 | FD96 | FD14 | HD24 | HD48 | C1TM |... | C4TM | MC1TM | ... | MC4TM	with query	6.179
CONFigure:NETWork[:CSWitched]:SOFFset	–7 to 7	with query	6.176
CONFigure:NETWork[:CSWitched]:TIMeout:MTC	0 s to 60 s | OFF	with query	6.183
CONFigure:NETWork[:CSWitched]:TIMeout:RLINk:TESTset	4 to 64 | OFF	with query	6.182
CONFigure:NETWork[:CSWitched]:TIMeout:RLINk[:MOBile]	4 to 64	with query	6.182

Command, Signalling	Parameter	Remark	Page
NPOWer measurement			
INITiate:NPOWer	–	no query	6.32
ABORt:NPOWer	–	no query	6.32
STOP:NPOWer	–	no query	6.32
CONTinue:NPOWer	–	no query	6.32
CONFigure:NPOWer:CONTrol	1 to 1000 | NONE,CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.33
CONFigure:NPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.34
CONFigure:NPOWer:CONTrol:STATistics	1 to 1000 | NONE	with query	6.33
CONFigure:NPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.32
FETCh:NPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE, 1 to 1000 | NONE	query only	6.32
READ[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
FETCh[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
SAMPle[:SCALar]:NPOWer?	–30 dBm to +30 dBm	query only	6.34
Power vs. time, access burst			
INITiate:POWer:ABURst[:GMSK]	–	no query	6.128
ABORt:POWer:ABURst[:GMSK]	–	no query	6.128
STOP:POWer:ABURst[:GMSK]	–	no query	6.128
CONTinue:POWer:ABURst[:GMSK]	–	no query	6.128
CONFigure:SUBarrays:POWer:ABURst[:GMSK]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.130
CALCulate:ARRay:POWer:ABURst[:GMSK]:AREA:LIMit:MATChing?	<Matching>	query only	6.133
CONFigure:POWer:ABURst[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.128
CALCulate:POWer:ABURst[:GMSK]:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.132

Command, Signalling	Parameter	Remark	Page
CALCulate:ARRay:POWer:ABURst[:GMSK]:LIMit:MATChing?	<Matching>	query only	6.133
FETCh:POWer:ABURst[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.129
CONFigure:POWer:ABURst[:GMSK]:TIME:BOFFset	–4.00 to +4.00	with query	6.129
READ[:SCALar]:POWer:ABURst[:GMSK]?	<Result>	query only	6.131
FETCh[:SCALar]:POWer:ABURst[:GMSK]?	<Result>	query only	6.131
SAMPle[:SCALar]:POWer:ABURst[:GMSK]?	<Result>	query only	6.131
READ:ARRay:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.132
FETCh:ARRay:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.132
SAMPle:ARRay:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.132
READ:SUBarrays:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.133
FETCh:SUBarrays:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.133
SAMPle:SUBarrays:POWer:ABURst[:GMSK]?	–100.0 to +20.0	query only	6.133
Power vs frame			
INITiate:POWer:FRAMe	–	no query	6.44
ABORt:POWer:FRAMe	–	no query	6.44
STOP:POWer:FRAMe	–	no query	6.44
CONTinue:POWer:FRAMe	–	no query	6.44
CONFigure:SUBarrays:POWer:FRAMe	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.46
CONFigure:POWer:FRAMe:CONTrol:DEFault	ON | OFF	with query	6.45
CONFigure:POWer:FRAMe:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.45
CONFigure:POWer:FRAMe:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.44
CONFigure:POWer:FRAMe:FCOunt	1 to 128	with query	6.44
READ[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
FETCh[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
SAMPle[:SCALar]:POWer:FRAMe:FPOWer<nr>?	<Result>	query only	6.47
FETCh:POWer:FRAMe:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 |	query only	6.44

Command, Signalling	Parameter	Remark	Page
	NONE		
READ:ARRay:POWer:FRAMe?	<Result>	query only	6.47
FETCh:ARRay:POWer:FRAMe?	<Result>	query only	6.47
SAMPle:ARRay:POWer:FRAMe?	<Result>	query only	6.47
READ:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47
FETCh:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47
SAMPle:SUBarrays:POWer:FRAMe?	<Result>	query only	6.47
POWer:MSLot measurement			
INITiate:POWer:MSLot	–	no query	6.48
ABORt:POWer:MSLot	–	no query	6.48
STOP:POWer:MSLot	–	no query	6.48
CONTinue:POWer:MSLot	–	no query	6.48
CONFigure:SUBarrays:POWer:MSLot	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.51
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:AVERage?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MAXimum?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MINimum?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.55
READ:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:AVERage?	–100.0 dB to +20.0 dB	query only	6.54
CONFigure:POWer:MSLot:CONTrol	SCALar | ARRay, 1 to 1000 | OFF	with query	6.49
DISPlay:POWer:MSLot:CONTrol:GRID	ON | OFF	with query	6.49

Command, Signalling	Parameter	Remark	Page
CONFigure:POWer:MSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.49
CONFigure:POWer:MSLot:CONTrol:DEFault	ON | OFF	with query	6.50
CONFigure:POWer:MSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.48
CONFigure:POWer:MSLot:FILTer	G500 | B600	with query	6.51
CONFigure:POWer:MSLot:LIMit:LINE:GLEVel	0.00 dB to +10.00 dB	with query	6.51
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:AVERage?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MAXimum?	<Matching>	query only	6.55
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MINimum?	<Matching>	query only	6.55
CALCulate:POWer:MSLot:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.53
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.55
READ:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:MAXimum?	–100.0 dB to +20.0 dB	query only	6.54
READ:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot:MINimum?	–100.0 dB to +20.0 dB	query only	6.54
CONFigure:POWer:MSLot:MVIew	<Mod_-1>,<Mod_0>, <Mod_1>, <Mod_2>	with query	6.50
CONFigure:POWer:MSLot:SCOunt	1 to 4	with query	6.50
FETCh:POWer:MSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.48

Command, Signalling	Parameter	Remark	Page
CONFigure:POWer:MSLot:TOFFset	–4.00 to +4.00	with query	6.50
READ[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
FETCh[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
SAMPle[:SCALar]:POWer:MSLot?	<Result>	query only	6.52
READ:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
FETCh:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
SAMPle:ARRay:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.53
READ:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54
FETCh:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54
SAMPle:SUBarrays:POWer:MSLot[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.54
Power vs PCL			
INITiate:POWer:PCL	–	no query	6.134
ABORt:POWer:PCL	–	no query	6.134
STOP:POWer:PCL	–	no query	6.134
CONTinue:POWer:PCL	–	no query	6.134
CONFigure:POWer:PCL:CCOunt	C3 | C7	with query	6.135
CONFigure:POWer:PCL:CHANnel	<Channel1>, ... ,<Channeln>	with query	6.135
CONFigure:POWer:PCL:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.135
CONFigure:POWer:PCL:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.134
READ[:SCALar]:POWer:PCL:PCLPower<PCL>?	<Result>	query only	6.137
FETCh[:SCALar]:POWer:PCL:PCLPower<PCL>?	<Result>	query only	6.137
SAMPle[:SCALar]:POWer:PCL:PCLPower<PCL>?	<Result>	query only	6.137
FETCh:POWer:PCL:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.134
READ[:SCALar]:POWer:PCL?	<Result>	query only	6.136
FETCh[:SCALar]:POWer:PCL?	<Result>	query only	6.136
SAMPle[:SCALar]:POWer:PCL?	<Result>	query only	6.136
CALCulate:POWer:PCL[:CURRent]:LIMit:MATChing?	OK | NMAU | NMAL | INV	query only	6.137

Command, Signalling	Parameter	Remark	Page
Power vs slot			
INITiate:POWer:SLOT	–	no query	6.35
ABORt:POWer:SLOT	–	no query	6.35
STOP:POWer:SLOT	–	no query	6.35
CONTinue:POWer:SLOT	–	no query	6.35
CONFigure:SUBarrays:POWer:SLOT	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.37
CONFigure:POWer:SLOT:CONTrol:DEFault	ON | OFF	with query	6.36
CONFigure:POWer:SLOT:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.36
CONFigure:POWer:SLOT:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.35
READ[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
FETCh[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
SAMPle[:SCALar]:POWer:SLOT:SPOWer<nr>?	<Result>	query only	6.37
FETCh:POWer:SLOT:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.35
READ:ARRay:POWer:SLOT?	<Result>	query only	6.38
FETCh:ARRay:POWer:SLOT?	<Result>	query only	6.38
SAMPle:ARRay:POWer:SLOT?	<Result>	query only	6.38
READ:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
FETCh:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
SAMPle:SUBarrays:POWer:SLOT?	<Result>	query only	6.38
Power vs slot (table)			
INITiate:POWer:XSLot	–	no query	6.39
ABORt:POWer:XSLot	–	no query	6.39
STOP:POWer:XSLot	–	no query	6.39
CONTinue:POWer:XSLot	–	no query	6.39
CONFigure:SUBarrays:POWer:XSLot	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<St	with query	6.42

Command, Signalling	Parameter	Remark	Page
	art>,<Samples>}		
CONFigure:POWer:XSLot:CONTrol:DEFault	ON | OFF	with query	6.40
CONFigure:POWer:XSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.40
CONFigure:POWer:XSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.39
CONFigure:POWer:XSLot:SCOunt	S128 | S256 | S384 | S512[,1 to 512]	with query	6.41
READ[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
FETCh[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
SAMPle[:SCALar]:POWer:XSLot:SPOWer<nr>?	<Result>	query only	6.43
FETCh:POWer:XSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.39
READ:ARRay:POWer:XSLot?	<Result>	query only	6.43
FETCh:ARRay:POWer:XSLot?	<Result>	query only	6.43
SAMPle:ARRay:POWer:XSLot?	<Result>	query only	6.43
READ:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
FETCh:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
SAMPle:SUBarrays:POWer:XSLot?	<Result>	query only	6.43
Power vs. time (normal burst, 8PSK modulation)			
INITiate:POWer[:NORMal]:EPSK	–	no query	6.112
ABORt:POWer[:NORMal]:EPSK	–	no query	6.112
STOP:POWer[:NORMal]:EPSK	–	no query	6.112
CONTinue:POWer[:NORMal]:EPSK	–	no query	6.112
CONFigure:SUBarrays:POWer[:NORMal]:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.122
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:AVERage?	<Matching>	query only	6.127
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MAXimum?	<Matching>	query only	6.127
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MINimum?	<Matching>	query only	6.127

Command, Signalling	Parameter	Remark	Page
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing[:CURRent]?	<Matching>	query only	6.127
READ:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
CONFigure:POWer[:NORMal]:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.114
CONFigure:POWer[:NORMal]:EPSK:CONTrol:DEFault	ON | OFF	with query	6.115
DISPlay:POWer[:NORMal]:EPSK:CONTrol:GRID	ON | OFF	with query	6.115
CONFigure:POWer[:NORMal]:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.114
CONFigure:POWer[:NORMal]:EPSK:CONTrol:RPMode	CURRent | AVERage | DCOMpens	with query	6.115
CONFigure:POWer[:NORMal]:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.113
CONFigure:POWer[:NORMal]:EPSK:FILTer	G500 | B600	with query	6.113
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer:ALL:DYNamic:ENABle	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<AreaNr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>:DYNamic<RgNr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.119
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.117
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:LOWer<nr>[:STATic]:ENABle	ON | OFF	with query	6.117
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer:ALL:DYNamic:ENABle	ON | OFF	with query	6.119
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:UPPer<nr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.119
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE:	<fromTPCL>, <toTPCL>,	with query	6.118

Command, Signalling	Parameter	Remark	Page
UPPer<nr>:DYNamic<nr>	<Correction>, ON | OFF		
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE: UPPer<nr>:DYNamic<nr>:ENABle	ON | OFF	with query	6.118
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE: UPPer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.116
CONFigure:POWer[:NORMal]:EPSK:LIMit:LINE: UPPer<nr>[:STATic]:ENABle	ON | OFF	with query	6.116
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit: MATChing:AVERage?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit: MATChing:MAXimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit: MATChing:MINimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
CALCulate:POWer[:NORMal]:EPSK:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.124
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit: MATChing[:CURRent]?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
READ:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.126
READ:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal]:EPSK:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:POWer[:NORMal]:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.113
CONFigure:POWer[:NORMal]:EPSK:TIME:BOFFset	–4.00 to +4.00	with query	6.113

Command, Signalling	Parameter	Remark	Page
READ[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.123
FETCh[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.123
SAMPle[:SCALar]:POWer[:NORMal]:EPSK?	<Result>	query only	6.123
READ:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal]:EPSK[:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126
Power vs. time (normal burst, GMSK modulation)			
INITiate:POWer[:NORMal][:GMSK]	–	no query	6.112
ABORt:POWer[:NORMal][:GMSK]	–	no query	6.112
STOP:POWer[:NORMal][:GMSK]	–	no query	6.112
CONTinue:POWer[:NORMal][:GMSK]	–	no query	6.112
CONFigure:SUBarrays:POWer[:NORMal][:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.122
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA: LIMit:MATChing:AVERage?	<Matching>	query only	6.127
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA: LIMit:MATChing:MAXimum?	<Matching>	query only	6.127
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA: LIMit:MATChing:MINimum?	<Matching>	query only	6.127
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA: LIMit:MATChing[:CURRent]?	<Matching>	query only	6.127
READ:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:AVERage?	–100.0 dB to +20.0 dB	query only	6.126
CONFigure:POWer[:NORMal][:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 |	with query	6.114

Command, Signalling	Parameter	Remark	Page
	NONE		
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.115
DISPlay:POWer[:NORMal][:GMSK]:CONTrol:GRID	ON | OFF	with query	6.115
CONFigure:POWer[:NORMal][:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.114
CONFigure:POWer[:NORMal][:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.113
CONFigure:POWer[:NORMal][:GMSK]:FILTer	G500 | B600	with query	6.113
CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>	ON | OFF	with query	6.121
CONFigure:POWer[:NORMal][:GMSK]:LIMit:ABPower<nr>:ENABle	ON | OFF	with query	6.121
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer:ALL:DYNamic:ENABle	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<AreaNr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.120
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>:DYNamic<RgNr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.119
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.117
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: LOWer<nr>[:STATic]:ENABle	ON | OFF	with query	6.117
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer:ALL:DYNamic:ENABle	ON | OFF	with query	6.119
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:ALL:DYNamic:ENABle	ON | OFF	with query	6.119
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:DYNamic<nr>	<fromTPCL>, <toTPCL>, <Correction>, ON | OFF	with query	6.118
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>:DYNamic<nr>:ENABle	ON | OFF	with query	6.118
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>[:STATic]	<StartTime>, <EndTime>, <StartRelLevel>, <EndRelLevel>, <StartAbsLevel>, <EndAbsLevel>, <Visibility>	with query	6.116
CONFigure:POWer[:NORMal][:GMSK]:LIMit:LINE: UPPer<nr>[:STATic]:ENABle	ON | OFF	with query	6.116
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing:AVERage?	MATC | NMAT | INV | NTSC | OUT	query only	6.127

Command, Signalling	Parameter	Remark	Page
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing:MAXimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing:MINimum?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
CALCulate:POWer[:NORMal][:GMSK]:LIMit:MATChing?	AvgBurstPowerCurr, PeakBurstPowerCurr, BurstMatching, AvgBurstPowerAvg	query only	6.124
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit: MATChing[:CURRent]?	MATC | NMAT | INV | NTSC | OUT	query only	6.127
READ:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MAXimum?	–100.0 dB dB to +20.0 dB	query only	6.126
READ:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MINimum?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:POWer[:NORMal][:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.113
CONFigure:POWer[:NORMal][:GMSK]:TIME:BOFFset	–4.00 to +4.00	with query	6.113
READ[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.123
FETCh[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.123
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]?	<Result>	query only	6.123
READ:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
FETCh:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
SAMPle:ARRay:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.125
READ:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126
FETCh:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126

Command, Signalling	Parameter	Remark	Page
SAMPle:SUBarrays:POWer[:NORMal][:GMSK][:CURRent]?	–100.0 dB to +20.0 dB	query only	6.126
POWer:MPR			
INITiate:POWer[:NORMal][:GMSK]:MPR	–	no query	6.138
ABORt:POWer[:NORMal][:GMSK]:MPR	–	no query	6.138
STOP:POWer[:NORMal][:GMSK]:MPR	–	no query	6.138
CONTinue:POWer[:NORMal][:GMSK]:MPR	–	no query	6.138
CONFigure:SUBarrays:POWer[:NORMal][:GMSK]:MPR	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.140
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.141
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.141
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.141
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.142
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.142
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:AVERage?	–100.0 to +20.0	query only	6.142
CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.139
CONFigure:POWer[:NORMal][:GMSK]:MPR:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.139
CONFigure:POWer[:NORMal][:GMSK]:MPR:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.138
CALCulate:POWer[:NORMal][:GMSK]:MPR:LIMit:MATChing?	<Result>	query only	6.143
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 to +20.0	query only	6.141
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 to +20.0	query only	6.141
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.141
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 to +20.0	query only	6.142
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 to +20.0	query only	6.142
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MAXimum?	–100.0 dB to +20.0 dB	query only	6.142
READ:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 to +20.0	query only	6.141
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 to +20.0	query only	6.141
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.141

Command, Signalling	**Parameter**	**Remark**	**Page**
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 to +20.0	query only	6.142
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 to +20.0	query only	6.142
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR:MINimum?	–100.0 dB to +20.0 dB	query only	6.142
FETCh:POWer[:NORMal][:GMSK]:MPR:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.138
READ[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.141
FETCh[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.141
SAMPle[:SCALar]:POWer[:NORMal][:GMSK]:MPR?	<Result>	query only	6.141
READ:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.141
FETCh:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.141
SAMPle:ARRay:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.141
READ:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.142
FETCh:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.142
SAMPle:SUBarrays:POWer[:NORMal][:GMSK]:MPR[:CURRent]?	–100.0 to +20.0	query only	6.142
MS Receiver Reports			
[SENSe:]RREPorts:COUNt?	<Counts>	query only	6.186
[SENSe:]RREPorts:DTX?	ON | OFF	query only	6.186
[SENSe:]RREPorts:NCELl?	<Channel>, 0 to 63 | NAN	query only	6.186
[SENSe:]RREPorts:RPCL?	0 to 31	query only	6.186
[SENSe:]RREPorts:RXLevel?	0 to 63 | NAN	query only	6.185
[SENSe:]RREPorts:RXQuality?	0 to 7 | NAN	query only	6.185
Receiver quality measurements, Continuous			
INITiate:RXQuality:BAVerage	–	no query	6.153
ABORt:RXQuality:BAVerage	–	no query	6.153
STOP:RXQuality:BAVerage	–	no query	6.153
CONTinue:RXQuality:BAVerage	–	no query	6.153
CONFigure:RXQuality:BAVerage:CONTrol	RFER | BER | BBB, 1 to 500 | OFF	with query	6.154
CONFigure:RXQuality:BAVerage:CONTrol:DEFault	ON | OFF	with query	6.156

Command, Signalling	**Parameter**	**Remark**	**Page**
CONFigure:RXQuality:BAVerage:CONTrol:PDATa[:TCH]:MSLot:LEVel:INDividual	<Level_0>, ..., <Level_7>	with query	6.155
CONFigure:RXQuality:BAVerage:CONTrol:PDATa[:TCH]:MSLot:RLEVel	–127 dB to +127 dB	with query	6.155
CONFigure:RXQuality:BAVerage:CONTrol:REPetition	FLIMit | ALIMits | NONE, STEP | NONE	with query	6.154
CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:LEVel:INDividual	<Level_0>, ..., <Level_7>	with query	6.155
CONFigure:RXQuality:BAVerage:CONTrol[:CSWitched][:TCH]:MSLot:RLEVel	–127 dB to +127 dB	with query	6.155
CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.155
CONFigure:RXQuality:BAVerage:CONTrol[:TCH]:LEVel:UTIMeslot	<Level>	with query	6.154
CONFigure:RXQuality:BAVerage:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.153
CONFigure:RXQuality:BAVerage:LIMit:CLIB	0 % to 100 %	with query	6.156
CONFigure:RXQuality:BAVerage:LIMit:CLII	0 % to 100 %	with query	6.156
CONFigure:RXQuality:BAVerage:LIMit:DBLer	0 % to 100 %	with query	6.156
CALCulate:RXQuality:BAVerage:LIMit:MATChing?	<Result>	query only	6.159
CONFigure:RXQuality:BAVerage:LIMit:USFBler	0 % to 100 %	with query	6.157
FETCh:RXQuality:BAVerage:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 500 | NONE	query only	6.153
FETCh[:SCALar]:RXQuality:BAVerage?	<Result>	query only	6.157
SAMPle[:SCALar]:RXQuality:BAVerage?	<Result>	query only	6.157
CONFigure:RXQuality:BAVerageLIMit:DEFault	ON | OFF	with query	6.157
CONFigure:RXQuality:BAVerageLIMit:FERRors	0 % to 100 %	with query	6.156
Receiver quality measurements, Single Shot			
INITiate:RXQuality:BER	–	no query	6.145
ABORt:RXQuality:BER	–	no query	6.145
STOP:RXQuality:BER	–	no query	6.145
CONTinue:RXQuality:BER	–	no query	6.145
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.145
CALCulate:RXQuality:BER:LIMit:MATChing?	<Result>	query only	6.152
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 50000 |	query only	6.145

Command, Signalling	Parameter	Remark	Page
	NONE		
CONFigure:RXQuality:BER:TSETup	T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10	with query	6.145
READ[:SCALar]:RXQuality:BER?	<Result>	query only	6.151
FETCh[:SCALar]:RXQuality:BER?	<Result>	query only	6.151
SAMPle[:SCALar]:RXQuality:BER?	<Result>	query only	6.151
CONFigure:RXQuality:BER<nr>:CONTrol	RFER | BER | BBB | BDBL, 1 to 50000 | NONE	with query	6.146
CONFigure:RXQuality:BER<nr>:CONTrol:DEFault	ON | OFF	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol:PDATa[:TCH]:MSLot: LEVel:INDividual	<Level_0>, ..., <Level_7>	with query	6.148
CONFigure:RXQuality:BER<nr>:CONTrol:PDATa[:TCH]:MSLot: RLEVel	–127 dB to +127 dB	with query	6.148
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition	ALIMits | FLIMit | NONE, STEP | NONE	with query	6.146
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel:UNTimeslot	–127 dB to +127 dB	with query	6.147
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel:UTIMeslot	<Level>	with query	6.147
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:FIVE	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:FOUR	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:ONE	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:SEVen	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:SIX	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:THRee	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:TWO	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: LEVel[:SLOT]:ZERO	<Level>	with query	6.149
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: MSLot:LEVel:INDividual	<Level_0>, ..., <Level_7>	with query	6.148
CONFigure:RXQuality:BER<nr>:CONTrol[:CSWitched][:TCH]: MSLot:RLEVel	–127 dB to +127 dB	with query	6.148

Command, Signalling	**Parameter**	**Remark**	**Page**
CONFigure:RXQuality:BER<nr>:LIMit:CLIB	0 % to 100 %	with query	6.150
CONFigure:RXQuality:BER<nr>:LIMit:CLII	0 % to 100 %	with query	6.149
CONFigure:RXQuality:BER<nr>:LIMit:DBLer	0 % to 100 %	with query	6.150
CONFigure:RXQuality:BER<nr>:LIMit:DEFault	ON | OFF	with query	6.150
CONFigure:RXQuality:BER<nr>:LIMit:FERRors	0 % to 100 %	with query	6.150
CONFigure:RXQuality:BER<nr>:LIMit:USFBler	0 % to 100 %	with query	6.150
CONFigure:RXQuality:CONTrol:DEFault	ON | OFF	with query	6.144
CONFigure:RXQuality:CONTrol:HTIMe	0 s to 100 s, 0 s to 100 s	with query	6.144
Signalling			
PROCedure: SIGNalling:PDATa:ACTion	SOFF | SON | CTMA | CTMB | CRS | CDLonly | DISConnect	no query	6.190
[SENSe:]SIGNalling:PDATa:SERVice?	IDLE | ATT | RAUP | AIPR | DIPR	query only	6.191
[SENSe:]SIGNalling:PDATa:STATe?	IDLE | ATT | RAUP | AIPR | DIPR	query only	6.191
PROCedure:SIGNalling:PDATa[:TCH]:MSLot:BS:SCONfig	<Enable_0>,..., <Enable_7>, <Level_0>,... <Level_7>	with query	6.191
PROCedure:SIGNalling[:CSWitched]:ACTion	SOFF | SON | MTC | SMS | CRELease | HANDover	no query	6.163
PROCedure:SIGNalling[:CSWitched]:DAI	NORMal | DECoder | ENCoder | ADEVice	with query	6.165
CONFigure:SIGNalling[:CSWitched]:SMS	<Text>	with query	6.165
[SENSe:]SIGNalling[:CSWitched]:SMS?	<Text>	query only	6.165
[SENSe:]SIGNalling[:CSWitched]:STATe?	SOFF | SON | SYNC | CEST | CPEN | CED	query only	6.164
PROCedure:SIGNalling[:CSWitched][:TCH]:CHANnel	<Number>	with query	6.165
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:BS:SCONfig: INDividual	<Enable_0>,<Enable_1>, ..., <Enable_7>, <PCL_0>, ..., <PCL_7>	with query	6.167
PROCedure:SIGNalling[:CSWitched][:TCH]:MSLot:MTIMeslot	0 to 7	with query	6.167
PROCedure:SIGNalling[:CSWitched][:TCH]:TADVance	0 bit to 63 bit	with query	6.165
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:CHCCombined	<ChannelNumber>, <Timeslot>, <PCL>	with query	6.166
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:FHOPping: SEQuence	A | B | C | D | OFF	with query	6.166

Command, Signalling	Parameter	Remark	Page
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:MS:PCL	0 to 31	with query	6.167
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot	2 to 6 | 0 to 7	with query	6.166
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:MS:PCL	0 to 31	with query	6.167
PROCedure:SIGNalling[:CSWitched][:TCH][:SSLot]:TIMeslot	2 to 6 | 0 to 7	with query	6.166
Speech Codec			
ROUTe:SPDecoder:OUTPut	HANDset | ANALyzer | ANA2 | ABOTh	with query	6.184
ROUTe:SPENcoder[:INPut]	HANDset | GENerator	with query	6.184
Spectrum due to modulation measurements: 8PSK modulation			
INITiate:SPECtrum:MODulation:EPSK	–	no query	6.95
ABORt:SPECtrum:MODulation:EPSK	–	no query	6.95
STOP:SPECtrum:MODulation:EPSK	–	no query	6.95
CONTinue:SPECtrum:MODulation:EPSK	–	no query	6.95
CONFigure:SUBarrays:SPECtrum:MODulation:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.96
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:DEFault	ON | OFF	with query	6.98
DISPlay:SPECtrum:MODulation:EPSK:CONTrol:GRID	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:MPOint<nr>:ENABle	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.97
CONFigure:SPECtrum:MODulation:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.95
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:MODE[:UPPer]	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE:REFPower[:UPPer]	<Minimum>, <Maximum>	with query	6.99
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.98
CONFigure:SPECtrum:MODulation:EPSK:LIMit:LINE	ON | OFF	with query	6.98

Command, Signalling	Parameter	Remark	Page
[:ASYMmetrical]:UPPer<nr>:ENABle			
FETCh:SPECtrum:MODulation:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.96
READ[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
FETCh[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
SAMPle[:SCALar]:SPECtrum:MODulation:EPSK?	<Result>	only query	6.101
READ:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:ARRay:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
READ:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:SUBarrays:SPECtrum:MODulation:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.102
Spectrum due to modulation measurements: GMSK modulation			
INITiate:SPECtrum:MODulation[:GMSK]	–	no query	6.95
ABORt:SPECtrum:MODulation[:GMSK]	–	no query	6.95
STOP:SPECtrum:MODulation[:GMSK]	–	no query	6.95
CONTinue:SPECtrum:MODulation[:GMSK]	–	no query	6.95
CONFigure:SUBarrays:SPECtrum:MODulation[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.100
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.96
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.98
DISPlay:SPECtrum:MODulation[:GMSK]:CONTrol:GRID	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:MPOint<nr>:ENABle	ON | OFF	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.97
CONFigure:SPECtrum:MODulation[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.95
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.100
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:MODE[:UPPer]	ON | OFF	with query	6.100

Command, Signalling	Parameter	Remark	Page
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE:REFPower[:UPPer]	<Minimum>, <Maximum>	with query	6.99
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>	<MinLevel>,<MaxLevel>,<AbsLevel>,<Enable>	with query	6.98
CONFigure:SPECtrum:MODulation[:GMSK]:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.98
FETCh:SPECtrum:MODulation[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.96
READ[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
FETCh[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
SAMPle[:SCALar]:SPECtrum:MODulation[:GMSK]?	<Result>	only query	6.101
READ:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:ARRay:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
READ:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
FETCh:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
SAMPle:SUBarrays:SPECtrum:MODulation[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.102
Spectrum due to switching measurements: 8PSK modulation			
INITiate:SPECtrum:SWITching:EPSK	–	no query	6.103
ABORt:SPECtrum:SWITching:EPSK	–	no query	6.103
STOP:SPECtrum:SWITching:EPSK	–	no query	6.103
CONTinue:SPECtrum:SWITching:EPSK	–	no query	6.103
CONFigure:SUBarrays:SPECtrum:SWITching:EPSK	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.108
CONFigure:SPECtrum:SWITching:EPSK:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.104
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:DEFault	ON | OFF	with query	6.105
DISPlay:SPECtrum:SWITching:EPSK:CONTrol:GRID	ON | OFF	with query	6.104
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:MPOint<nr>:ENABle	ON | OFF	with query	6.105
CONFigure:SPECtrum:SWITching:EPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.104

Command, Signalling	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching:EPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:DEFault	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE:MODE[:UPPer]	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>	<Power level>, <Limit at 0.4 MHz>, <Limit at 0.6 MHz>, <Limit at 1.2 MHz>, <Limit at 1.8 MHz>,<Enable>	with query	6.106
CONFigure:SPECtrum:SWITching:EPSK:LIMit:LINE[:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.106
FETCh:SPECtrum:SWITching:EPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.103
READ[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
FETCh[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
SAMPle[:SCALar]:SPECtrum:SWITching:EPSK?	<Result>	only query	6.109
READ:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
FETCh:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
SAMPle:ARRay:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB	only query	6.109
READ:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
FETCh:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching:EPSK?	–100.0 dB to +20.0 dB, ...	query only	6.100
SAMPle:SUBarrays:SPECtrum:SWITching?	–100.0 dB to +20.0 dB, ...	query only	6.53
Spectrum due to switching measurements: GMSK modulation			
INITiate:SPECtrum:SWITching[:GMSK]	–	no query	6.103
ABORt:SPECtrum:SWITching[:GMSK]	–	no query	6.103
STOP:SPECtrum:SWITching[:GMSK]	–	no query	6.103
CONTinue:SPECtrum:SWITching[:GMSK]	–	no query	6.103
CONFigure:SUBarrays:SPECtrum:SWITching[:GMSK]	ALL | ARIThmetical | MINimum | MAXimum | IVAL,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.108
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.104

Command, Signalling	Parameter	Remark	Page
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:DEFault	ON | OFF	with query	6.105
DISPlay:SPECtrum:SWITching[:GMSK]:CONTrol:GRID	ON | OFF	with query	6.104
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol: MPOint<nr>:ENABle	ON | OFF	with query	6.105
CONFigure:SPECtrum:SWITching[:GMSK]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.104
CONFigure:SPECtrum:SWITching[:GMSK]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE:DEFault	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE: MODE[:UPPer]	ON | OFF	with query	6.107
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE [:ASYMmetrical]:UPPer<nr>	<Power level>, <Limit at 0.4 MHz>, <Limit at 0.6 MHz>, <Limit at 1.2 MHz>, <Limit at 1.8 MHz>,<Enable>	with query	6.106
CONFigure:SPECtrum:SWITching[:GMSK]:LIMit:LINE [:ASYMmetrical]:UPPer<nr>:ENABle	ON | OFF	with query	6.106
FETCh:SPECtrum:SWITching[:GMSK]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	only query	6.103
READ[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
FETCh[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
SAMPle[:SCALar]:SPECtrum:SWITching[:GMSK]?	<Result>	only query	6.109
READ:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
FETCh:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
SAMPle:ARRay:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB	only query	6.109
READ:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
FETCh:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
SAMPle:SUBarrays:SPECtrum:SWITching[:GMSK]?	–100.0 dB to +20.0 dB, ...	query only	6.110
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.160
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.160
Trigger			
TRIGger[:SEQuence]:DEFault	ON | OFF	with query	6.163

Command, Signalling	Parameter	Remark	Page
TRIGger[:SEQuence]:SOURce	SIGNalling | FRUN | RFPower | IFPower	with query	6.162
TRIGger[:SEQuence]:THReshold	LOW | MEDium | HIGH	with query	6.162
Wide band power measurements			
INITiate:WPOWer	–	no query	6.30
ABORt:WPOWer	–	no query	6.30
STOP:WPOWer	–	no query	6.30
CONTinue:WPOWer	–	no query	6.30
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 ... 10000, SONerror | NONE,STEP | NONE	with query	6.31
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.30
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 ... 10000 | NONE	query only	6.31
READ[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31
FETCh[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31
SAMPle[:SCALar]:WPOWer?	–30 dBm to +30 dBm	query only	6.31

Alphabetical Command Lists

Table 6-3 Remote control commands: *Non Signalling* mode

Command (Non Signalling, alphabetical)	**Page**
ABORt:MODulation:EVMagnitude:EPSK	*6.77*
ABORt:MODulation:MERRor:EPSK	*6.89*
ABORt:MODulation:OVERview:EPSK	*6.72*
ABORt:MODulation:XPERror[:GMSK]	*6.64*
ABORt:MODulation[:PERRor]:EPSK	*6.83*
ABORt:MODulation[:PERRor][:GMSK]	*6.56*
ABORt:NPOWer	*6.32*
ABORt:POWer:FRAMe	*6.44*
ABORt:POWer:MSLot	*6.48*
ABORt:POWer:SLOT	*6.35*
ABORt:POWer:XSLot	*6.39*
ABORt:POWer[:NORMal]:EPSK	*6.10*
ABORt:POWer[:NORMal][:GMSK]	*6.10*
ABORt:POWer[:NORMal][:GMSK]:MPR	*6.24*
ABORt:RFGenerator	*6.5*
ABORt:SPECtrum:MODulation:EPSK	*6.95*
ABORt:SPECtrum:MODulation[:GMSK]	*6.95*
ABORt:SPECtrum:SWITching:EPSK	*6.103*
ABORt:SPECtrum:SWITching[:GMSK]	*6.103*
ABORt:WPOWer	*6.30*
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:AVERage?	*6.55*
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MAXimum?	*6.55*
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing:MINimum?	*6.55*
CALCulate:ARRay:POWer:MSLot:AREA:LIMit:MATChing[:CURRent]?	*6.55*
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:AVERage?	*6.55*
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MAXimum?	*6.55*
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing:MINimum?	*6.55*
CALCulate:ARRay:POWer:MSLot:LIMit:MATChing[:CURRent]?	*6.55*
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:AVERage?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MAXimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing:MINimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:AREA:LIMit:MATChing[:CURRent]?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:AVERage?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MAXimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing:MINimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal]:EPSK:LIMit:MATChing[:CURRent]?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:AVERage?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MAXimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing:MINimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:AREA:LIMit:MATChing[:CURRent]?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:AVERage?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MAXimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing:MINimum?	*6.23*
CALCulate:ARRay:POWer[:NORMal][:GMSK]:LIMit:MATChing[:CURRent]?	*6.23*
CALCulate:MODulation:EVMagnitude:EPSK:LIMit:MATChing?	*6.81*
CALCulate:MODulation:MERRor:EPSK:LIMit:MATChing?	*6.93*
CALCulate:MODulation:OVERview:EPSK:LIMit:MATChing?	*6.76*
CALCulate:MODulation:XPERror[:GMSK]:LIMit:MATChing?	*6.70*

Command (Non Signalling, alphabetical)	Page
CALCulate:MODulation[:PERRor]:EPSK:LIMit:MATChing?	*6.87*
CALCulate:MODulation[:PERRor][:GMSK]:LIMit:MATChing?	*6.62*
CALCulate:POWer:MSLot:LIMit:MATChing?	*6.53*
CALCulate[:SCALar]:POWer[:NORMal]:EPSK:LIMit:MATChing?	*6.20*
CALCulate[:SCALar]:POWer[:NORMal][:GMSK]:LIMit:MATChing?	*6.20*
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol	*6.78*
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:DEFault	*6.79*
CONFigure:MODulation:EVMagnitude:EPSK:CONTrol:REPetition	*6.78*
CONFigure:MODulation:EVMagnitude:EPSK:EREPorting	*6.77*
CONFigure:MODulation:MERRor:EPSK:CONTrol	*6.90*
CONFigure:MODulation:MERRor:EPSK:CONTrol:DEFault	*6.91*
CONFigure:MODulation:MERRor:EPSK:CONTrol:REPetition	*6.90*
CONFigure:MODulation:MERRor:EPSK:EREPorting	*6.89*
CONFigure:MODulation:OEMP:EPSK:LIMit:AVERage	*6.74*
CONFigure:MODulation:OEMP:EPSK:LIMit:DEFault	*6.75*
CONFigure:MODulation:OEMP:EPSK:LIMit:P95Th	*6.75*
CONFigure:MODulation:OEMP:EPSK:LIMit[:CURRent]	*6.74*
CONFigure:MODulation:OVERview:EPSK:CONTrol	*6.73*
CONFigure:MODulation:OVERview:EPSK:CONTrol:DEFault	*6.74*
CONFigure:MODulation:OVERview:EPSK:CONTrol:REPetition	*6.73*
CONFigure:MODulation:OVERview:EPSK:EREPorting	*6.72*
CONFigure:MODulation:XPERror[:GMSK]:CONTrol	*6.65*
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault	*6.66*
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:REPetition	*6.65*
CONFigure:MODulation:XPERror[:GMSK]:EREPorting	*6.64*
CONFigure:MODulation:XPERror[:GMSK]:FILTer	*6.65*
CONFigure:MODulation:XPERror[:GMSK]:LIMit:AVERage	*6.67*
CONFigure:MODulation:XPERror[:GMSK]:LIMit:DEFault	*6.67*
CONFigure:MODulation:XPERror[:GMSK]:LIMit:LOWer:MODE	*6.67*
CONFigure:MODulation:XPERror[:GMSK]:LIMit:UPPer:MODE	*6.67*
CONFigure:MODulation:XPERror[:GMSK]:LIMit[:CURRent]	*6.66*
CONFigure:MODulation:XPERror[:GMSK]:TIME:DECode	*6.65*
CONFigure:MODulation[:PERRor]:EPSK:CONTrol	*6.84*
CONFigure:MODulation[:PERRor]:EPSK:CONTrol:DEFault	*6.85*
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STOP:MODulation[:PERRor][:GMSK]	*6.56*
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STOP:POWer:SLOT	*6.35*
STOP:POWer:XSLot	*6.39*
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7 Remote Control – Program Examples

The following program examples illustrate how to solve typical measurement tasks in the *Non Signalling* and in the *Signalling* mode. To keep the syntax as short and simple as possible, the programs were written with the aid of *Winbatch*, a batch job tool organizing and simplifying the transfer of commands and data between the controller and the instrument.

Winbatch uses device names such as *CMUBASE, CMUGSMNS, CMUGSMSIG* which are previously defined and assigned to the primary address, secondary address, and some general device settings. With these device names, a complete command line reads:

```
CMUBASE: <CMU_Command>
```

where `<CMU_Command>` may be any of the commands (setting commands or queries) specified within the function group and mode identified by the device name *CMUBASE.* Program sequences consisting of commands that are defined in several function groups and modes can be re-used with an exchanged device name.

In addition to these data transfer commands, *Winbatch* provides *WHILE, GOTO*, and *IF* statements to express conditions and define loops. With the statement

```
WHILE CMUGSM: SENS:SIGN:STAT? <> SYNC
```

the instrument waits until it has reached the signalling state *Synchronized* before it executes the following commands.

For a C program assigning secondary addresses refer to chapter 7 of the CMU200 manual.

GSM-MS Non Signalling Measurements

The CMU generates a GSM signal which is configured, output via RF 3, fed in via RF 4, and measured with the appropriate analyzer settings. To see which analyzer settings are necessary, it is recommended to carry out the measurement manually first. Before doing so and running the program, connect RF 1 to RF 2 using a coax cable, in analogy to the test setup suggested in chapter 2. Also, configure your *Winbatch* settings such that *CMUBASE* is the device name for the CMU *BASE* system and *CMUGSMNS* denotes function group *GSM900-MS Non Signalling*.

```
ECHO ON

FPRINT ...........................................................................
FPRINT    INITIALISATION ROUTINE:
FPRINT    ASK FOR THE IDENTIFIER OF THE CMU, RESET THE INSTRUMENT,
FPRINT    DEFINE THE SECONDARY ADDRESSES FOR ALL AVAILABLE FUNCTION GROUPS
FPRINT ...........................................................................

CMUBASE: *IDN?                                   Identification query
CMUBASE: *RST;*OPC?                              Reset the instrument; prevent the following
                                                   command to be executed before *RST is
                                                   complete
CMUBASE: *CLS                                    Clear output buffer, set status byte
CMUBASE: SYST:REM:ADDR:SEC 1,"RF_NSig"           Define all function groups
CMUBASE: SYST:REM:ADDR:SEC 2,"GSM900MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 3,"GSM900MS_NSig"
CMUBASE: SYST:REM:ADDR:SEC 4,"GSM1800MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 5,"GSM1800MS_NSig"
CMUBASE: SYST:REM:ADDR:SEC 6,"GSM1900MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 7,"GSM1900MS_NSig"

FPRINT ............................................................................
FPRINT   CONNECTORS + ATTENUATION
FPRINT .............................................................................

CMUGSMNS: INP:STAT RF4                      Define input connector RF4
CMUGSMNS: OUTP:STAT RF3                     Define output connector RF3
CMUGSMNS: SENS:CORR:LOSS:INP2 0.0           Make sure that external attenuations are set
CMUGSMNS: SENS:CORR:LOSS:OUTP2 0.0              to zero

FPRINT .............................................................................
FPRINT    GENERATOR SETTINGS
FPRINT .............................................................................

CMUGSMNS: CONF:RFG:MOD:BIT:SEL DUMM         Select GSM dummy burst to be generated
CMUGSMNS: CONF:RFG:MOD:TSEQ:SEL GSM0        Select training sequence
CMUGSMNS: CONF:RFG:MOD:TRAN BURS            Select signal shape (burst signal)
CMUGSMNS: SOUR:RFG:FREQ:CHAN 900 MHZ        SetRF carrier frequency
CMUGSMNS: SOUR:RFG:LEV:UTIM -5              Set RF level in used timeslot
CMUGSMNS: INIT:RFG;*OPC?                    Switch on RF generator

FPRINT .............................................................................
FPRINT    ANALYZER SETTINGS
FPRINT .............................................................................

CMUGSMNS: RFAN:CHAN 900 MHZ                 Adjust analyzer frequency to generator freq.
CMUGSMNS: RFAN:TSEQ GSM0                    Adjust training sequence analyzed
CMUGSMNS: SYST:ERR?                         Read error queue

FPRINT .............................................................................
FPRINT    CONFIGURE THE POWER MEASUREMENT
FPRINT .............................................................................

CMUGSMNS: CONF:POW:CONT SCAL,1              Scalar results, one burst per statistics cycle
CMUGSMNS: CONF:POW:CONT:REP SING,NONE,NONE  Single shot measurement, no stop on error
CMUGSMNS: CONF:POW:MPR:CONT SCAL,1          Same settings as before, but for  combined
CMUGSMNS: CONF:POW:MPR:CONT:REP SING,NONE,NONE  power and modulation measurement

FPRINT .............................................................................
FPRINT    SETTLE THE EXPECTED POWER (+OVERSHOOT MARGIN) AND MEASURE THE POWER
FPRINT    REMEMBER: RFG POWER -5 dBm
FPRINT .............................................................................

CMUGSMNS: LEV:MAX 0                         Adjust expected maximum level
CMUGSMNS: READ:POW:MPR?                     Start single shot measurement, wait until it is
                                                terminated, and return scalar power and
                                                modulation results

FPRINT .............................................................................
FPRINT    FREE TX MEASUREMENT DSP RESOURCES
FPRINT .............................................................................

CMUGSMNS: ABOR:POW:MPR                      Abort combined power/mod measurement,
                                                free resources

FPRINT .............................................................................
FPRINT    RFG POWER -10 dBm, USING FASTER WIDEBAND PEAK POWER METER
FPRINT .............................................................................

CMUGSMNS: SOUR:RFG:LEV:UTIM -10;*OPC?       Select RF level in used timeslot
CMUGSMNS: LEV:MAX -5                        Adjust expected maximum level
CMUGSMNS: READ:SPOW?                        Start single shot wide band peak power
                                                measurement, wait until it is terminated,
                                                and return result
```

The measurement can be easily repeated at other RF levels or with different configurations.

GSM Signalling Measurements

A GSM mobile phone is connected to the bidirectional connector RF2 as described in chapter 2 and tested. We assume that the mobile phone is capable of operating in the GSM900 band; in the example involving a GSM900/1800 handover, an appropriate dual-band mobile must be used. Moreover, a test SIM card for the mobile phone is required.

Call Setup to the Mobile Phone, Simple RX/TX Measurements

Preliminary configurations for a power and receiver quality measurement are defined, and the network parameters are set for maximum speed of the call procedure. The IMSI of the mobile phone must be known to set up a call; it can be either reported to the tester or will be determined during the location update. The first alternative will speed up the call procedure.

Next, the CMU generates a BCCH (C0 carrier) signal for synchronization. The mobile phone searches the whole channel range for this BCCH and camps on it for some mobile-specific time until it reaches the *Synchronized* state. In this state, configuration settings made at the beginning are checked, and the CMU sets up a call to the mobile phone. Parameters such as the PCL and channel should be defined before the call is setup to reduce signalling time (no PCL/channel change). As soon as the call is established, power and receiver quality measurements are performed.

Before running the program, configure your *Winbatch* settings such that *CMUBASE* is the device name for the CMU *BASE* system and *CMUGSM* denotes function group *GSM900-MS Signalling*.

```
ECHO ON

FPRINT ..........................................................................
FPRINT    INITIALISATION ROUTINE:
FPRINT    ASK FOR THE IDENTIFIER OF THE CMU, RESET THE INSTRUMENT,
FPRINT    DEFINE THE SECONDARY ADDRESSES FOR ALL AVAILABLE FUNCTION GROUPS
FPRINT ..........................................................................

CMUBASE: *IDN?                                    Identification query
CMUBASE: *RST;*OPC?                               Reset the instrument; prevent the following
                                                    command to be executed before *RST is
                                                    complete
CMUBASE: *CLS                                     Clear output buffer, set status byte
CMUBASE: SYST:REM:ADDR:SEC 1,"RF_NSig"            Define all function groups
CMUBASE: SYST:REM:ADDR:SEC 2,"GSM900MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 3,"GSM900MS_NSig"
CMUBASE: SYST:REM:ADDR:SEC 4,"GSM1800MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 5,"GSM1800MS_NSig"
CMUBASE: SYST:REM:ADDR:SEC 6,"GSM1900MS_Sig"
CMUBASE: SYST:REM:ADDR:SEC 7,"GSM1900MS_NSig"

FPRINT ...........................................................................
FPRINT   CONNECTORS + ATTENUATION
FPRINT ...........................................................................

CMUGSM: INP:STAT RF2                              Define input connector RF2
CMUGSM: OUTP:STAT RF2                             Define output connector RF2
CMUGSM: SENS:CORR:LOSS:INP2 1.0                   Define external attenuation to compensate
CMUGSM: SENS:CORR:LOSS:OUTP2 1.0                    for known cable losses

FPRINT ...........................................................................
FPRINT   NETWORK PARAMETERS, SELECTED FOR MAXIMUM SPEED OF THE CALL PROCEDURE
FPRINT   THE IMSI REQUIRED MAY DIFFER FROM THE EXAMPLE (=DEFAULT) SETTINGS
FPRINT ...........................................................................

CMUGSM: CONF:NETW:SMOD:IMSI:MNC 001;MCC 01;MSIN '1000000095'      Set IMSI
CMUGSM: CONF:NETW:REQ:IMSI OFF                    Switch IMSI request off
```

```
CMUGSM: CONF:NETW:REQ:IMEI OFF                    Switch IMEI request off
CMUGSM: CONF:NETW:REQ:AUTH OFF                    Switch authentication request off
CMUGSM: CONF:NETW:REQ:HAND OFF                    Switch handover request off
CMUGSM: CONF:NETW:SMOD:SCH FACC                   Signalling via FACCH
CMUGSM: CONF:NETW:SMOD:PCH FAST                   Fast power change (over FACCH)

FPRINT .............................................................................
FPRINT   CONFIGURATION OF A SINGLE SHOT BER MEASUREMENT
FPRINT .............................................................................

CMUGSM: CONF:RXQ:CONT:HTIM 0.2,0.0                Reduce holdoff times for AGC and
                                                    bit stream synchronization
CMUGSM: CONF:RXQ:BER1:CONT:LEV:UTIM -102.0        Absolute level in used timeslot
CMUGSM: CONF:RXQ:BER1:CONT:LEV:UNT -20.0          Relative level in unused timeslot
CMUGSM: CONF:RXQ:BER1:CONT:REP NONE,NONE          No stop on error
CMUGSM: CONF:RXQ:BER1:CONT BER,129                Bit error rate measurement over 129 frames
CMUGSM: CONF:RXQ:BER:TSET T1                      Store configuration in test setup 1


FPRINT .............................................................................
FPRINT   CONFIGURATION OF A SINGLE SHOT POWER MEASUREMENT
FPRINT .............................................................................

CMUGSM: CONF:POW:MPR:CONT SCAL,10                 Scalar results, 10 bursts per statistics cycle
CMUGSM: CONF:POW:MPR:CONT:REP SING,NONE,NONE      Single shot measurement, no stop on error


FPRINT .............................................................................
FPRINT   DEFINITION FOR BCCH BS POW: -85 dBm / Channel 5
FPRINT .............................................................................

CMUGSM: CONF:BSS:CCH:LEV -85.0;*OPC?              Absolute power of BCCH BS signal
CMUGSM: CONF:BSS:CCH:CHAN 30;*OPC?                Channel number of BCCH BS signal

FPRINT .............................................................................
FPRINT   DEFINITION FOR TESTSET BS POW: -85 dBm (-102 dBm) / Channel 1 / PCL 5
FPRINT .............................................................................

CMUGSM: CONF:BSS:TCH:LEV:UTIM -85.0;*OPC?         Absolute power of TCH BS signal, used TS
CMUGSM: CONF:BSS:CHAN 1;*OPC?                     Channel number of TCH BS signal
CMUGSM: CONF:NETW:POW 5;*OPC?                     Power control level of the mobile
                                                    setting up a call

FPRINT .............................................................................
FPRINT   GENERATING THE BCCH
FPRINT .............................................................................

CMUGSM: PROC:SIGN:ACT SON;*OPC?                   Switch on BCCH signal

FPRINT .............................................................................
FPRINT   WAIT FOR LOCATION UPDATE
FPRINT .............................................................................

REPORT OFF
WHILE CMUGSM: SENS:SIGN:STAT? <> SYNC             Wait until signalling state Synchronized is
                                                    reached, then go to next command
REPORT ON

FPRINT .............................................................................
FPRINT   CALL PROCEDURE (CHECK IMSI IF THIS PROCEDURE FAILS)
FPRINT .............................................................................

CMUGSM: PROC:SIGN:ACT MTC;*OPC?                   Initiate a mobile terminating call

FPRINT .............................................................................
FPRINT   REDUCE THE BS POWER. THIS AFFECTS THE BER BUT NOT THE TX MEASUREMENTS
FPRINT .............................................................................
```

```
CMUGSM: PROC:BSS:LEV:UTIM -102;*OPC?            Absolute power of TCH BS signal, used TS

FPRINT .............................................................................
FPRINT   START THE SINGLE SHOT BER (RXQ:BER) AND THE POWER/MODULATION MEASUREMENT
FPRINT   THE TX MEASUREMENTS ARE FASTER AND WILL BE FINISHED FIRST
FPRINT   WHILE THE RXQ:BER MEAS. IS RUNNING THE RXLEV AND RXQUAL CAN BE QUERIED
FPRINT .............................................................................

CMUGSM: INIT:RXQ:BER;*OPC?                       Initiate single shot BER measurement
CMUGSM: INIT:POW:MPR;*OPC?                       Initiate combined power/mod. measurement

WHILE CMUGSM: FETC:POW:MPR:STAT? !{} RDY         Wait until power/mod. measurement is in the
                                                 RDY (ready) state, then go to next command
CMUGSM: FETC:POW:MPR?                            Return scalar power/mod. results

[MEAS1_1]
IF CMUGSM: FETC:RXQ:BER:STAT? {} RDY GOTO MEAS1_2 Check whether BER measurement is ready
CMUGSM: RREP:RXL?                                Return RXLev reported by the mobile
CMUGSM: RREP:RXQ?                                Return RXQual reported by the mobile
GOTO MEAS1_1
[MEAS1_2]
CMUGSM: FETC:RXQ:BER?                            Read out BER measurement results
```

To change the traffic channel without dropping the call, use the `PROC:SIGN:CHAN` command. To change the PCL of the mobile, use `PROC:SIGN:MS:PCL`. To change both parameters simultaneously, use `PROC:SIGN:CHCC`.

Handover

The example of the last section is repeated for a GSM900/1800 dual-band mobile phone. To this end, extend your *Winbatch* settings such that *CMUDCS* denotes function group *GSM1800-MS Signalling*. Repeat and modify the program of the last section in the following way:

➢ Before the BCCH signal is generated, set the parameters for call setup and for the measurements in function group *GSM1800-MS Signalling:*

```
CMUDCS: INP:STAT RF2                             Define input connector RF2
CMUDCS: OUTP:STAT RF2                            Define output connector RF2
CMUDCS: SENS:CORR:LOSS:INP2 2.0                  Define external attenuation to compensate
CMUDCS: SENS:CORR:LOSS:OUTP2 2.0                    for known cable losses

CMUDCS: CONF:NETW:SMOD:PCH FAST                  Fast power change (over FACCH)

CMUDCS: CONF:RXQ:CONT:HTIM 0.2,0.0               Reduce holdoff times for AGC and
                                                    bit stream synchronization
CMUDCS: CONF:RXQ:BER1:CONT:LEV:UTIM -102.0       Absolute level in used timeslot
CMUDCS: CONF:RXQ:BER1:CONT:LEV:UNT -20.0         Relative level in unused timeslot
CMUDCS: CONF:RXQ:BER1:CONT:REP NONE,NONE         No stop on error
CMUDCS: CONF:RXQ:BER1:CONT BER,129               Bit error rate measurement over 129 frames
CMUDCS: CONF:RXQ:BER:TSET T1                     Store configuration in test setup 1

CMUDCS: CONF:POW:MPR:CONT SCAL,10                Scalar results, 10 bursts per statistics cycle
CMUDCS: CONF:POW:MPR:CONT:REP SING,NONE,NONE     Single shot measurement, no stop on error

CMUDCS: CONF:BSS:CHAN 512                        Channel number of TCH BS signal
CMUDCS: CONF:NETW:POW 5                          Power control level of the mobile
                                                    setting up a call
```

➢ Generate the BCCH signal and set up the call as shown in the previous section. This means that the mobile operates on the GSM900 band while the signalling procedures are carried out.

➢ As soon as the call is established `RXQuality` and other measurements can be performed in the GSM900 band. Instead initiate a dual-band handover to GSM1800:

```
FPRINT .............................................................................
FPRINT   DUALBAND HANDOVER
FPRINT .............................................................................

CMUGSM: CONF:HAND:TARG 'GSM1800MsDualBand'          Define target band for handover
CMUGSM: PROC:SIGN:ACT HAND;*OPC?                    Initiate handover procedure

REPORT OFF
WHILE CMUDCS: SENS:SIGN:STAT? <> CED                Wait until signalling state Call Established
                                                      Dualband  is reached, then continue
REPORT ON

CMUDCS: SENS:SIGN:STAT?                             Query signalling state (printout)

FPRINT .............................................................................
FPRINT   CHANNEL 512, PCL 0
FPRINT .............................................................................

CMUDCS: INIT:RXQ:BER                                Initiate single shot BER measurement
CMUDCS: INIT:POW:MPR                                Initiate combined power/mod. measurement

WHILE CMUDCS: FETC:POW:MPR:STAT? !{} RDY            Wait until power/mod. measurement is in the
                                                    RDY (ready) state, then go to next command
CMUDCS: FETC:POW:MPR?                               Return scalar power/mod. results

FPRINT .............................................................................
FPRINT   CALL RELEASE
FPRINT .............................................................................

CMUDCS: PROC:SIGN:ACT CREL;*OPC?
```

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